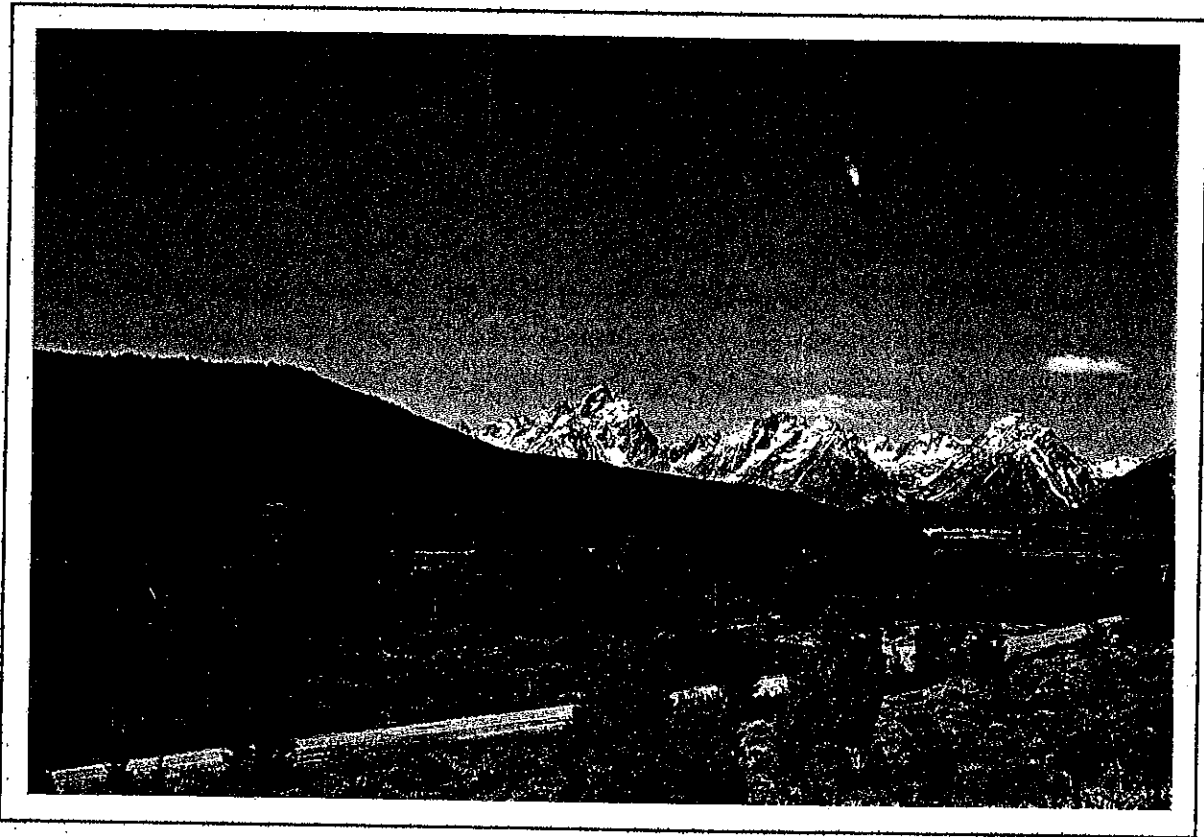


FINAL REPORT
Pt. 1: TEXT & ANALYSIS

"MONITORING BREEDING BIRD POPULATIONS
IN GRAND TETON NATIONAL PARK"

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Project Title: "MONITORING BREEDING BIRD POPULATIONS IN
GRAND TETON NATIONAL PARK: 1995-1997"

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EXECUTIVE SUMMARY

- the objectives of a GTNP breeding bird monitoring program are reviewed and summarized, and put in the perspective of i. challenges posed by migrant birds and ii. contributions of on-site vs off-site influences on population variation;
- criteria for selection and establishment of 30 permanent monitoring sites within GTNP are described, with emphases on coverage of all GTNP major habitat types, site accessibility, effects of natural disturbance within sites, and potential for monitoring rarer as well as common breeding species;
- monitoring protocols are detailed for censuses in 5-10 ha fixed and mapped sites, using a combination of area and point census techniques, with multiple site visits;
- following 3 seasons of work on the project, monitoring site establishment is completed, and breeding bird census results over several years (or longer) are reported and synthesized;
- data analyses are conducted to the extent permitted by the existing short-term data base: breeding bird species and densities within and between sites (habitats) and years are addressed;
- one monitoring site, in willow habitat, is replicated at Glacier and Rocky Mountain National Parks, adding a potential for monitoring region-wide variation in breeding bird populations; experimental exclosures in a willow site are established to help determine the interactions of browsers, insect and insectivorous bird densities;
- significant advantages will accrue with longer-term monitoring, and the value of extending the monitoring program is stressed.

A. REPORT OVERVIEW

This document is the Final Report on NPS-funded project # CA-1460-5-0010 covering a 3-y period from summer 1995 through summer 1997. The immediate goals of the project were to instigate a system for monitoring the densities of breeding bird species, by establishment of fixed sites as a basis for a long term monitoring plan and of census protocols that can detect changes of breeding species and their densities over successive years. The monitoring scheme is conducted largely within Grand Teton National Park (GTNP), but covers habitats and an avifauna representative of the Greater Yellowstone Ecosystem (GYE) and the central-northern Rocky Mountains in general.

In the Introduction (B) below, the rationale for the monitoring program, its goals and perceived utility for lands management and conservation both in the public and private spheres, are reiterated, closely following an Appendix to the original proposal submitted to NPS in Fall 1994. In a following section, some Considerations (C) of the specific challenges of monitoring an avifauna with a large migratory component that spends a considerable part of the annual cycle, the non-breeding season, generally in distant and different habitats, are introduced. Of particular concern are difficulties in identifying causal effects of population trends where only breeding densities are monitored. Given both the potential advantages and limitations of a breeding bird monitoring scheme, its Design Criteria (D) were chosen, as described below, with a view to take maximum advantage of a personnel force that might, over the extended or projected term, potentially be limited in numbers, availability, expertise, or field time.

The overall characteristics of the GTNP avifauna are reviewed in section (E), where the diversity and distribution of the breeding species are summarized, and the relative composition of the avifauna by migrants versus residents; the geographic position of GTNP relative to range limits of some breeding species, the incidence of rarities and their current status, and known or perceived populational trends in the longer and shorter term are discussed. There follows a section (F) on the vegetation and habitats in the park, their floristics, distributions, and structural characteristics, and a more detailed description of the sites selected for use in the monitoring program. Analysis of the present data set follows (section G), in as much detail as is permitted by the limited duration of the study. Despite the short time base of data in hand, its analysis seems sufficient to allow both a variety of quantitative observations on diversity, density and distribution of GTNP breeding bird species, and (perhaps more importantly) an appreciation of the benefits that will accrue from extension of the monitoring program over a longer time frame. Some of these potential benefits, and a review of the additional power that analyses of causes and effects of on-site versus off-site factors will derive from a longer term data set, are summarized in a final section (H). The value of the monitoring program to description and particularly understanding population trends will clearly expand geometrically as it is extended over future years.

B INTRODUCTION

1. BACKGROUND

Long-term studies on breeding bird species and densities are an important tool for evaluating the impact of both local and distant

influences on breeding bird populations. For residents, species that remain all year in or near the breeding habitat, local effects include those operating on-site during the non-breeding season as well as during the breeding season. For migrant species, those that breed on-site but leave to spend the non-breeding season in other locations, often distant and usually of quite different habitat composition, there are both on-site influences on breeding population densities, such as inter-year changes in vegetation structure and productivity, and off-site or distant influences, including factors that affect over-wintering success in the non-breeding habitat and others that influence a successful transit between wintering and breeding grounds. Migrant species span a considerable range of off-season movements, from those that shift elevationally or locally into different (adjacent) habitats, to those medium-distance migrants moving largely to areas in the southern and southwestern US, to long-distance migrants, participants in a neotropical-nearctic ecosystem of enormous size and complexity.

There is much continuing concern over declining breeding densities of migratory songbirds, particularly in but not limited to the eastern U.S. (e.g. Keast & Morton 1974; Terborgh 1989; Smithsonian Institution 1991; Martin and Finch 1995). Notably, not all analyses of the trends are overwhelmingly pessimistic (New York Times B9, June 10 1997). The more likely causal factors associated with downtrends are clearing and increased fragmentation of breeding habitats, and reduced availability of wintering habitat, but there are other potential concerns (eg. disease, nest parasitism, pollution). To date, most attention has been focussed on the breeding migrants of the NE forests, and their wintering habitats on

Caribbean islands, on the Caribbean slope of Central America, and in northern South America.

With respect to migrant bird populations of the GYE, in general the details of their wintering ranges are unknown. However, many paruline warblers of the northern and central Rockies winter in western Mexico, where they are common in lowland edge habitats and can comprise 25-50% of local winter bird densities (Hutto 1980, Cody 1983, Terborgh 1989); these wintering habitats also are vanishing at alarming rates (Hutto 1986), although on the whole they appear less threatened than those on which the migrants of eastern deciduous forests of North America depend.

In response to this concern, the National Fish and Wildlife Foundation has initiated the Neotropical Migratory Bird Conservation Program (National Fish and Wildlife Foundation, 1992), which involves cooperative partnerships among federal, state, and local government agencies, academic institutions, and conservation organizations in North and Latin America. The first comprehensive nongame bird conservation program initiated since the passage of the Migratory Bird Treaty Act of 1918, its goal is to improve monitoring, research, management, and education programs involving neotropical migratory birds and their habitats. Primary monitoring goals include 1) obtaining reliable information on the population status of neotropical migratory birds to allow assessment of population trends, and 2) expanding surveys in North America to include inadequately covered species and regions (National Fish and Wildlife Foundation, 1992).

The size of migrant populations can vary year-to-year in response to the vagaries of overwintering success, and the same variation can occur even in short-distance migrants and residents. In addition to off-site

effects, local effects within the breeding habitat obviously can influence breeding bird densities. Further, breeding habitats may change over the longer term in areal extent or degree of fragmentation, and may vary among years in qualities that affect their carrying capacities for breeding birds. Environmental variations, both abiotic and biotic, can affect survival at any stage in the life-cycle, producing variations in breeding density and associated factors (habitat preference, community structure and organization). Whether or not the consequences of such extrinsic and intrinsic variability alter or obscure patterns in the breeding community itself varies; in some cases, density changes produce readily interpretable alterations in bird communities (e.g. via density compensation, or shifts in habitat occupancy), while in others such interpretations are apparently not possible (see, e.g. Wiens 1985, 1988 and references therein).

Some intrinsic variation in breeding bird density among years, e.g. attributable to on-site effects that change carrying capacity, is both usual and with clear explanation. Overwinter precipitation affects insect productivity in more xeric habitats, and larger territory sizes, correlated with lower resource availability, may reduce densities in drier years (Cody 1981). In some wetland habitats, standing water may buffer the spring productivity against drier winters, but vegetation structure and perhaps in consequence resource productivity are clearly affected by other factors such as the presense of large browsing ungulates (Chadde and Kay 1990), and likely by changes in water levels (through runon and runoff via e.g. beaver activity, etc.).

The assessment of long-term trends in bird densities may be used as a form of bioassay of the state of the local environments. Information from such studies can provide region-wide indicators that, given a sufficiently

comprehensive data base, can segregate local from distant influences on populations. Such indicators can be incorporated into management strategies to aid in determining which local strategies may be necessary (and feasible) to help maintain the biota.

2. GOALS

The GTNP Breeding Bird Monitoring Program has a single primary objective: to evaluate local, regional, and to some extent continental, populational trends of birds that breed in the northern Rocky Mountains in general, and in the Greater Yellowstone Ecosystem (GYE) in particular, through the development and implementation of a long-term monitoring program for breeding birds in each of the major vegetation types representative of the GYE.

In addition, the proposal has several secondary objectives:

- to identify and distinguish between factors in year-to-year population variations that are intrinsically-driven (i.e., within-park) and those that are extrinsic (i.e. controlled by influences outside the GYE);
- to examine the relationships among habitat availability, habitat utilization and productivity, and species composition and densities in the study habitats;
- to present and disseminate information on bird populational trends to management agencies in the most useful fashion.

C. GENERAL CONSIDERATIONS IN MONITORING MIGRANT BIRD POPULATIONS

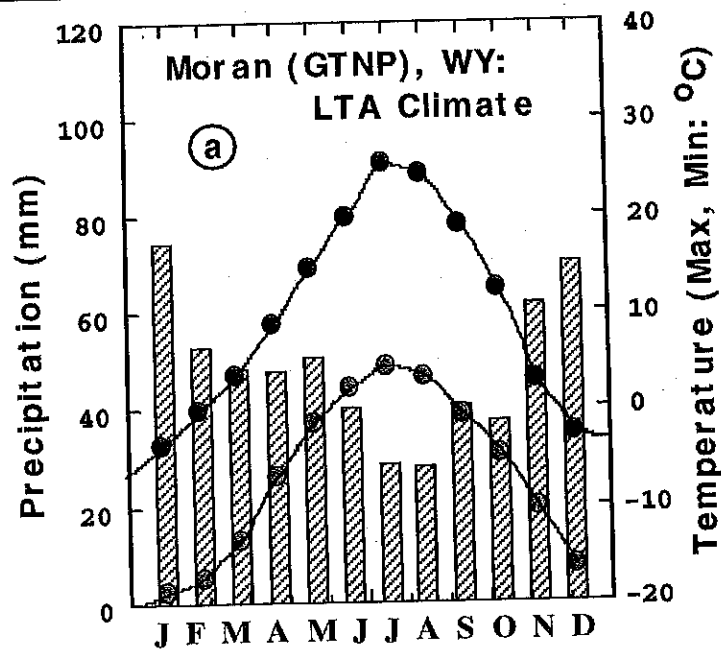
1. MIGRATION STRATEGIES

Bird migration strategies are evolved as a response to adverse conditions in the breeding habitat during the non-breeding season, "winter." Strong seasonality is a feature of sites at either high elevation or high latitude, and both are met in Jackson Hole (minimum elevation 2000m; ca. 43° N) and GTNP. Seasonality is particularly apparent in temperatures (Fig. 1a); the three coldest months have mean monthly maxima below zero (0° C), and only the three warmest months have mean monthly minima greater than zero. An average month shows a range of about 20° C between mean maximum and mean minimum temperatures, and a large proportion of this range is sub-zero much of the year. Precipitation is mostly from snowfall, that that typical of winter months is around twice that of rainfall in summer months, producing notably xeric conditions in many habitats during the breeding season.

Not only is the climate very seasonal, but also unpredictable year-to-year. This is illustrated in Fig. 1b, summarizing nearly a half-century of weather records at Moran. For both annual precipitation (mean = 584mm) and annual temperature (mean = 2.26° C), around one-third of the annual records lie beyond one standard deviation from the means.

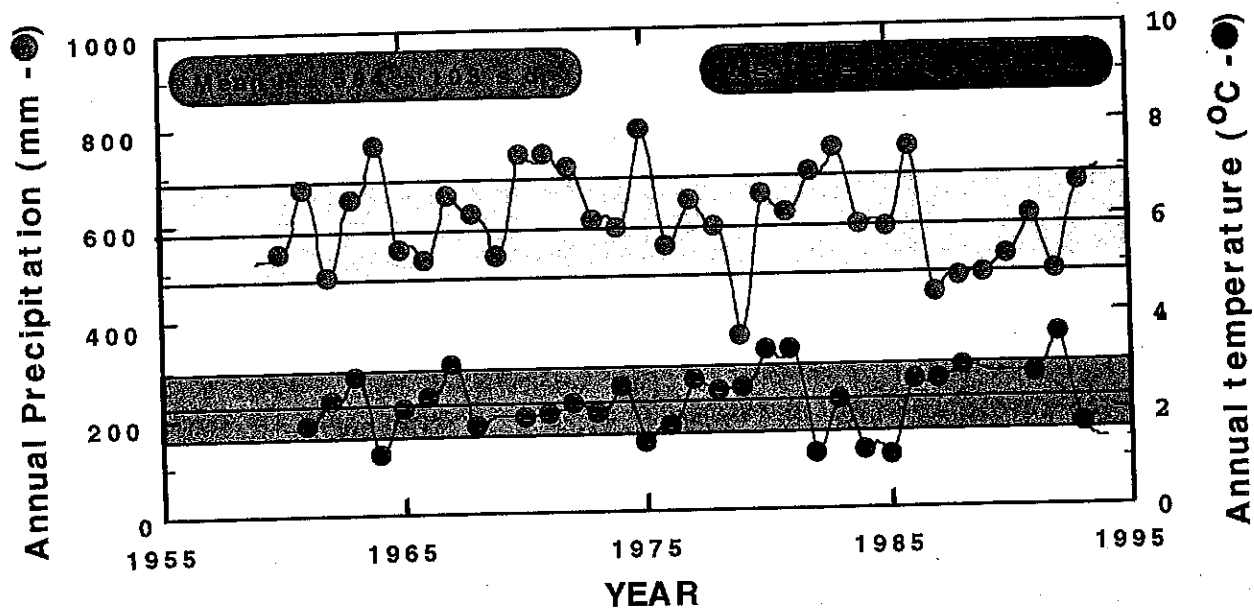
The next major point to be stressed is that there is no simple dichotomy between resident and migratory birds, rather there is a continuum of strategies to cope with the non-breeding season. At one extreme, populations may be truly resident and spend the non-breeding season wholly within the breeding habitat; at the other, populations are wholly migratory, overwinter in quite different habitats that are reached by long-distance travel of sometimes thousands of kilometers. Between these two extremes are species that overwinter locally but in different habitats, perhaps at different elevations, and species that undertake short-

Figure 1. GTNP Weather: Seasonality and Predictability



b. Moran (GTNP), WY:

Annual Precipitation (mm) and Temperature (°C)



distance migrations and/or perhaps overwinter in similar habitat elsewhere, perhaps distant some hundreds rather than thousands of kilometers from the breeding grounds. Another form of intermediacy is found in species in which a part of the population migrates but a part is resident (as in Orange-crowned warblers and Hutton's vireos of the southern Californian oak woodlands.)

Often, related species that share a breeding area such as GTNP have quite different migration strategies. This is illustrated in three taxonomic groups that are common constituents of the breeding avifauna of GTNP: the thrushes *Turdinae*, the sparrows *Emberizinae*, and the warblers *Parulinae*. Six common breeding thrush species of GTNP are represented in Fig. 2a, only one of which (American robin -see Appendix for Latin names) winter relatively close to its breeding grounds in the park, and others are distributed over varying latitudinal ranges to the south in the non-breeding season, one (Veery) venturing as far south as southern Brasil. Note that the three congeneric species, Hermit thrush, Swainson's thrush, and Veery, are all quite different in their wintering ranges, and also in their winter habitats. The first utilizes scrub habitats (such as chaparral in southern California) in winter, the second dry woodland, and the third tropical evergreen forest.

The emberizine sparrows (Fig. 2b) are a dominant component of GTNP habitats in the summer, and all except the marginally resident Song Sparrow undertake relative short-distance migrations in the non-breeding season. These thick-billed species are largely dependent on seeds in the winter, and clearly there is greater availability at higher latitudes of seeds than insects in the northern winters. Accordingly, all of the emberizines winter in North America (north of the isthmus of Tehuantepec in southern

**Figure 2a. JACKSON HOLE THRUSHES:
WINTERING RANGES AND HABITATS**

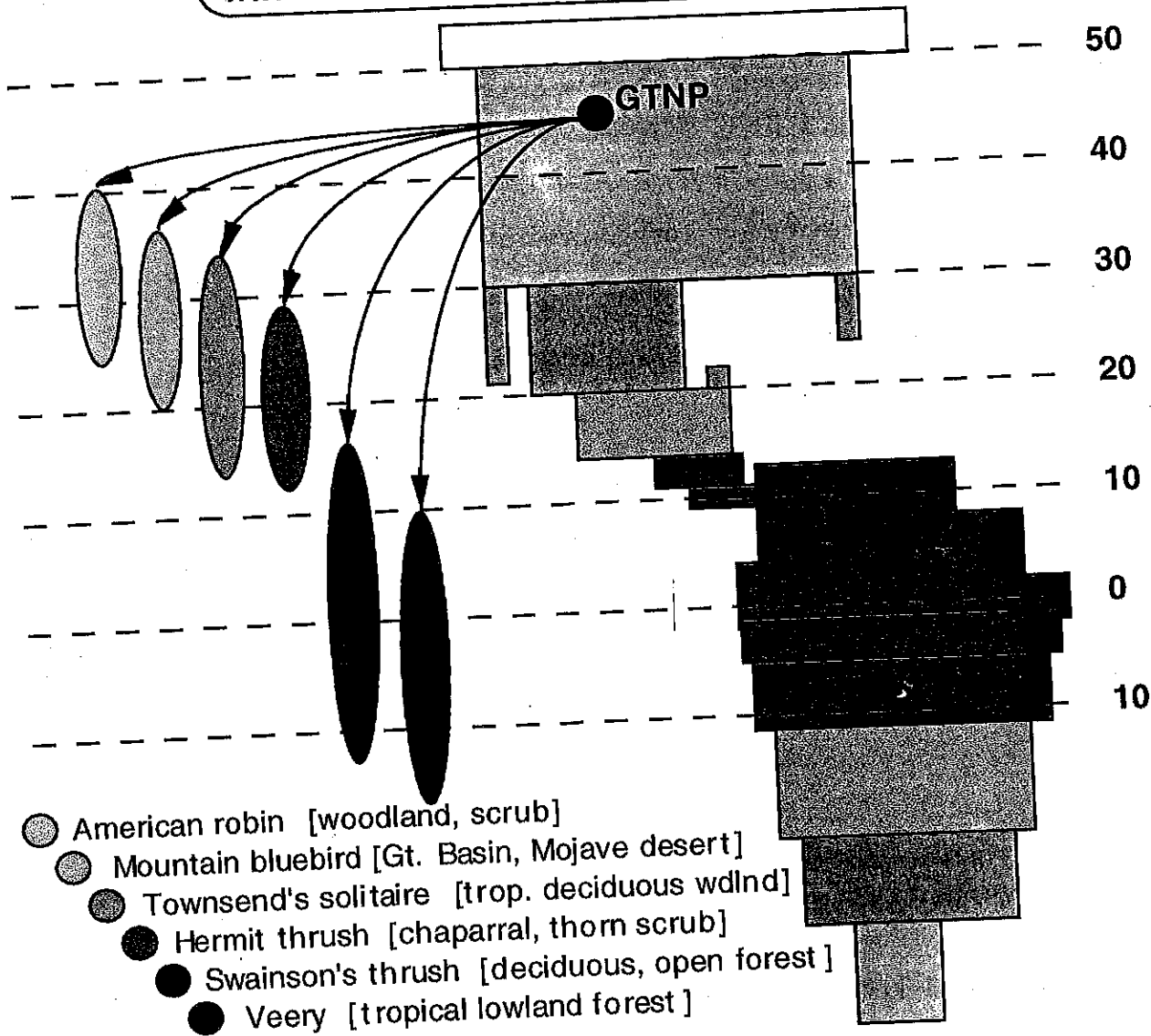
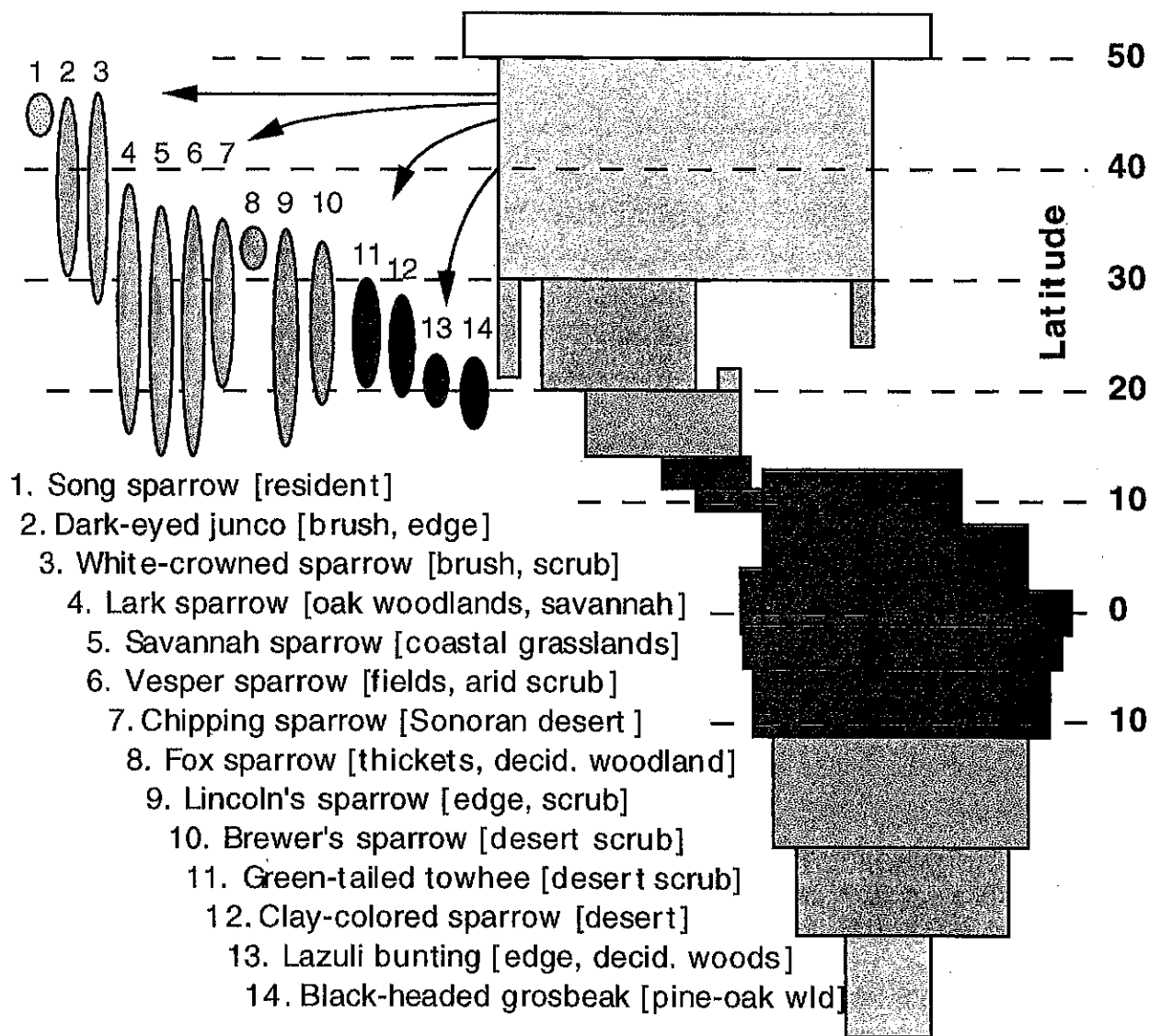


**Figure 2b. JACKSON HOLE SPARROWS:
WINTERING RANGES AND HABITATS**

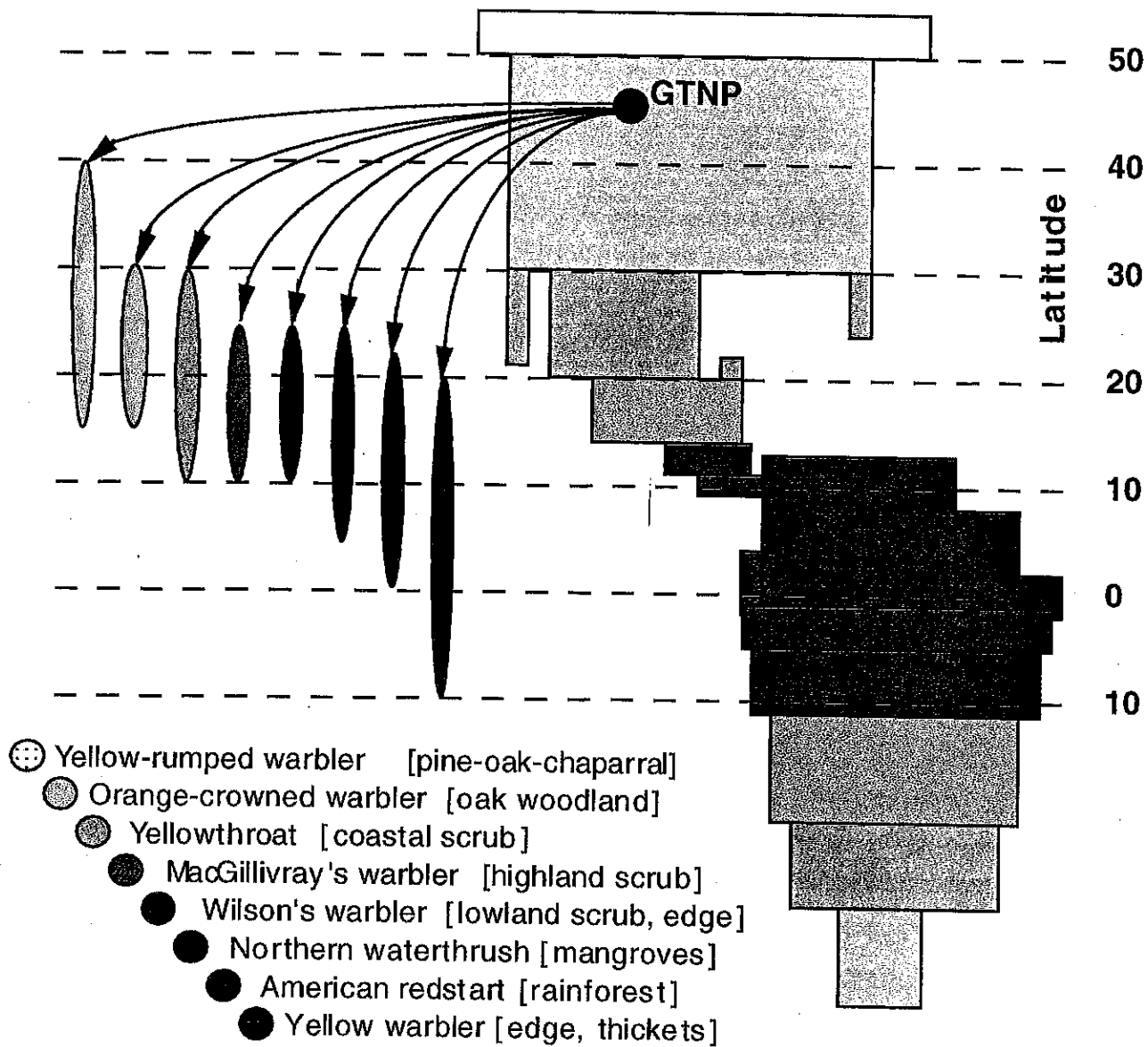


Mexico.) However, again there is within the group a broad range of overwintering latitudes, and a diversity of overwintering habitats. Note again that closely related species seem at least as disparate as unrelated species in terms of migration strategies. Compare related species such as Song, Fox and Lincoln's sparrows, for example, and again the three *Spizella* species, Chipping, Brewer's and Clay-colored sparrows.

Paruline warblers constitute another major group, with emberizines, of a largely North American family, and again they are well represented in the breeding avifauna of GTNP. Unlike the sparrows, they are thin-billed and insectivorous year-round; the exception proves the rule, as Yellow-rumped warbler is somewhat thicker-billed, eats some fruits in the winter (e.g. in southern California chaparral and woodland habitats), and overwinters considerably further north than do other parulines. In general, the parulines winter largely at tropical latitudes, Yellow warbler (congeneric with Yellow-rumped warbler) venturing furthest south and well into South America. A segregation of species by winter habitats is conspicuous; for example, at 20° N on the Pacific coast of Mexico, one finds wintering Northern waterthrush in mangroves and thickets and Common yellowthroat in grassy brush around estuaries, Wilson's warbler in second-growth and American redstart in evergreen forest in the lowlands, and MacGillivray's warbler in the highlands.

Overall, there is a considerable array of migration strategies, classified by both latitudinal position, range (extent), and wintering habitat. Species that may share breeding habitat in GTNP are likely to encounter very different conditions, in different regions and different habitats, in the non-breeding season, and degree of taxonomic relationship

Figure 2c. JACKSON HOLE WARBLERS:
WINTERING RANGES and HABITATS



is correlated apparently more with differences in migration modes than with similarities.

2. ON-SITE VS OFF-SITE EFFECTS

Population regulation in species that spend part of the annual cycle in breeding habitat and another part is distant and different wintering habitat pose some interesting but challenging questions. These were recently addressed in some detail by Sherry & Holmes (1995). Fig. 3 sets the conceptual scene in a bird population breeding in GTNP and wintering, for example, in northern South America. Individuals surviving overwinter and reaching the breeding grounds in GTNP are potentially affected by the type, areal extent and quality of breeding habitat they find in spring. Breeding and recruitment ensue in GTNP, and following the return migration to South America a similar set of factors potentially affect the overwinter survival of the population.

These factors are listed somewhat more explicitly in Fig. 4. The challenge is to understand changes year to year in breeding populations ΔP in GTNP, this being the only component of the system that is measured and monitored. A series of on-site effects affect settlement and thereafter recruitment on the breeding site, and a series of basically similar effects influences overwinter survival and the size of the population available for breeding the following spring. These factors are somewhat obvious and most are potentially measurable. However, the logistic problems in measuring them are overwhelming. Take for example the potential for returning spring migrants to encounter suitable habitat, both available and in good condition for breeding purposes, during the return migration before reaching GTNP. Unless strong philopatry mandates otherwise,

**Figure 3. NEOTROPICAL WINTERING BIRDS
WITH NEARCTIC BREEDING RANGES**

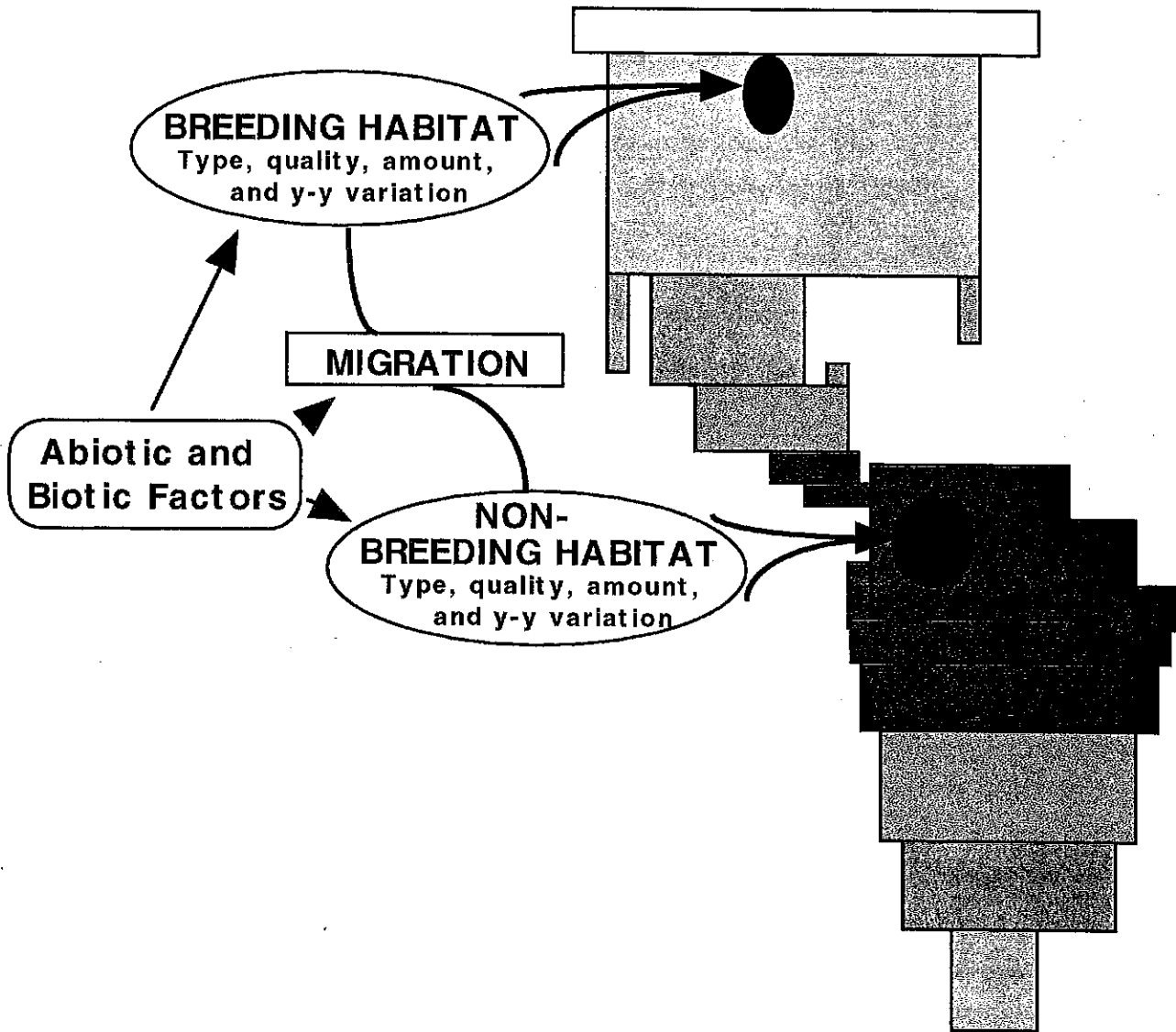


Figure 4. On- and off-site effects on breeding population density

Measure and Explain:

POPULATION
CHANGE YR-YR
 ΔN

?

Due to:

OR

Due to:

ON-SITE EFFECTS

- A. Poor Recruitment Previous Year
- B. Poor Overwinter Survival (residents)
- C. Poor Conditions This Year
 - 1. Late season
 - 2. Bad year (too wet, too dry)
 - 3. Competitors, predators, nest parasites too prevalent

OFF-SITE EFFECTS

- A. Poor Migration Survival
- B. Poor Overwinter Survival
 - 1. Winter habitat loss
 - 2. Winter habitat of poor quality
 - 3. Winter habitat overcrowded
- C. Better Breeding Habitat Available Elsewhere
 - 1. JH on edge of range
 - 2. JH habitats marginal for species
 - 3. Central, or southerly, or better habitats syphon off returning breeders

breeding habitat that is encountered earlier (to the south) will filter off the returning migrants, an off-site effect that would not be discernible on either wintering or breeding grounds, but only through evaluation of habitat along the migration route.

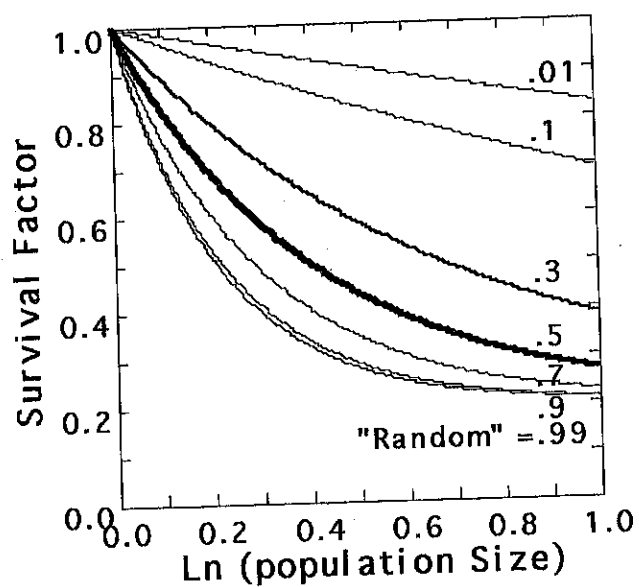
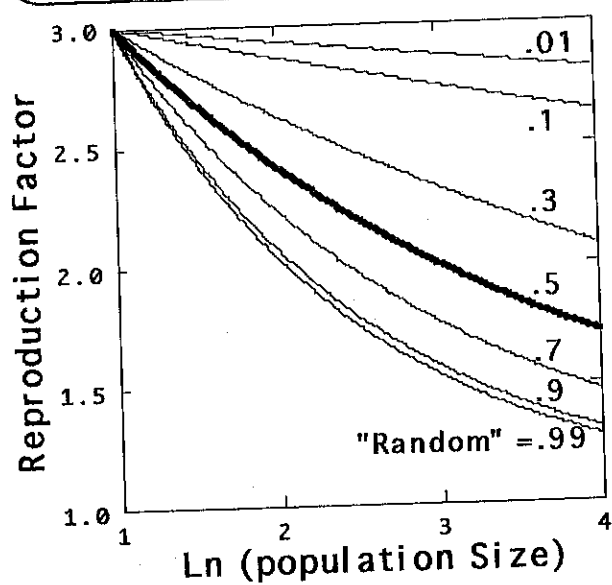
3. SIMULATIONS: VARIABILITY IN POPULATION SIZE

Variation in size in breeding populations can be generated by variations in on-site effects year to year and by variations in off-site effects. A simple simulation model illustrates the consequences of these effects, where they are generated by weather variations in breeding conditions and in overwintering conditions. Fig. 5 shows the elements of this model.

Recruitment takes place in the breeding habitat, where the population size has a multiplier, "reproductive factor" -see ordinate of Fig. 5a, that doubles the population in an average year. Per capita doubling occurs when breeding population is at intermediate levels, $\log(Nr) = 3$, and the reproductive factor is density dependent, being higher at smaller population sizes and lower in larger populations. Further, the multiplier for average years (heavy line in Fig. 5a) varies randomly to simulate variable climate; a family of reproductive factor curves shows the breeding response of the population relative to the abiotic conditions in that year and the size of the breeding population.

A similar process governs survival at the wintering grounds. Survival here is also density dependent, such that a smaller proportion of the population survives if the initial population size is larger (Fig. 5b). In an average winter and at intermediate population size, the overwintering population is halved. Again, more individuals survive in "good" winters

Figure 5: Reproduction and Survival Functions for Simulation Model



and fewer in "bad" winters, as a function of random weather variation. In summary the population doubles in the breeding season and is halved in the wintering season, in a fashion that is density dependent and is subject to random variation in weather around the climatic average.

Firstly, the model can be run without density dependence. The result is that population persistence is strongly attenuated (Fig. 6a), and random variation in weather brings about its early demise (essentially a random walk to an absorbing barrier). The addition of some density dependence dramatically enhances population persistence, even in the minimal instance of having at least 50 individuals supportable in the winter habitat (Model 2, Fig. 6b). But note that the population, while apparently long-term persistent, undergoes dramatic fluctuations in size. In the figure, all simulations are replicated runs with the same initial conditions; a wide range of outcomes is possible, from populations that are apparently increasing or decreasing over the longer term (here 50 y), populations with boom and bust cycles, that show aperiodic outbreaks, or even apparent cycling behavior. With the full density-dependence conditions of Fig. 5, populations still exhibit a wide range of long-term behaviors with identical initial conditions. Some outcomes are shown in Fig. 6c, where steady population size over the longer term appears to be the exception rather than the rule.

The lesson here for monitoring studies is a simple one: natural variations in climate that affect breeding and overwintering success can have conspicuous consequences for the stability of the population in question. These can of course be buffered by population responses not considered here, such as e.g. variable clutch size or other aspect of reproductive effort, variable choice of breeding habitat or foraging ecology,

Figure 6a. Simulation model with no density dependence

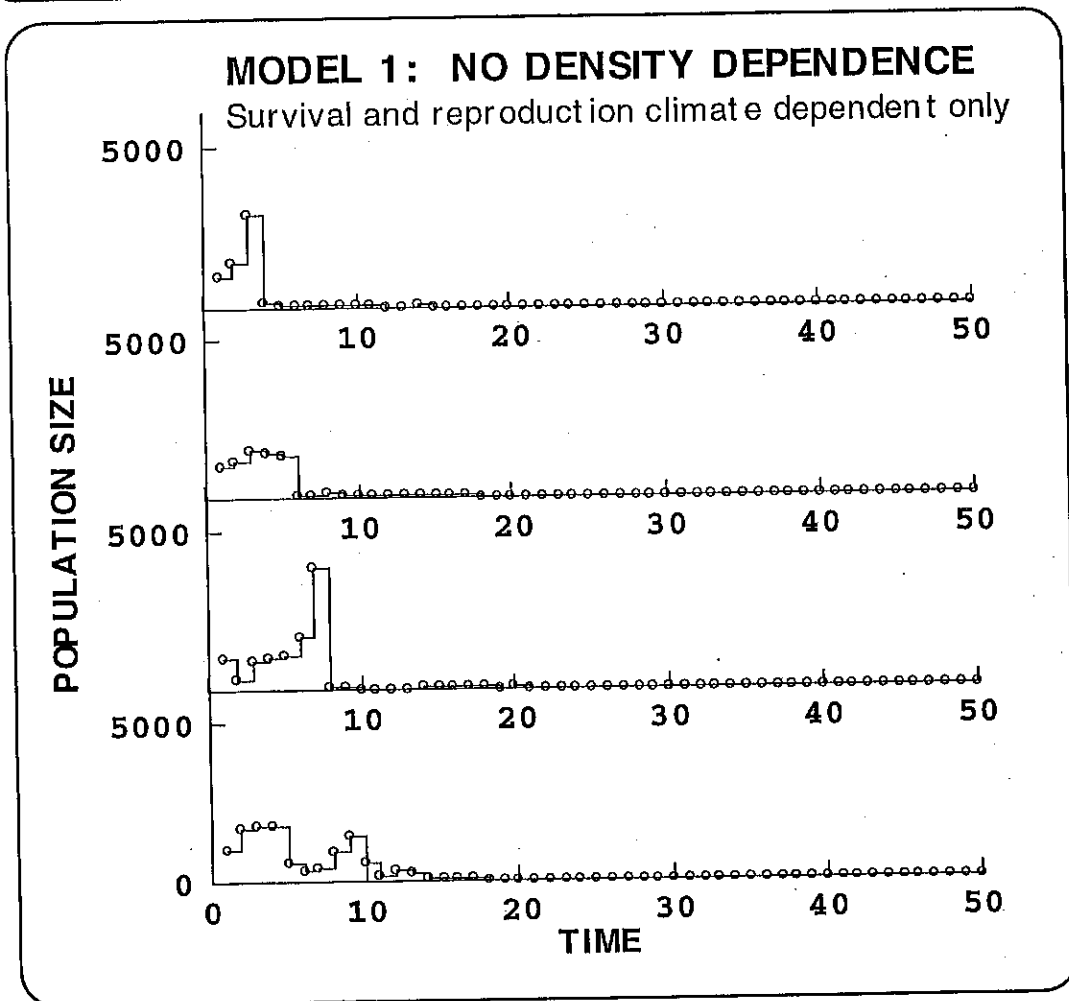


Figure 6b. Simulation model with minimal density dependence

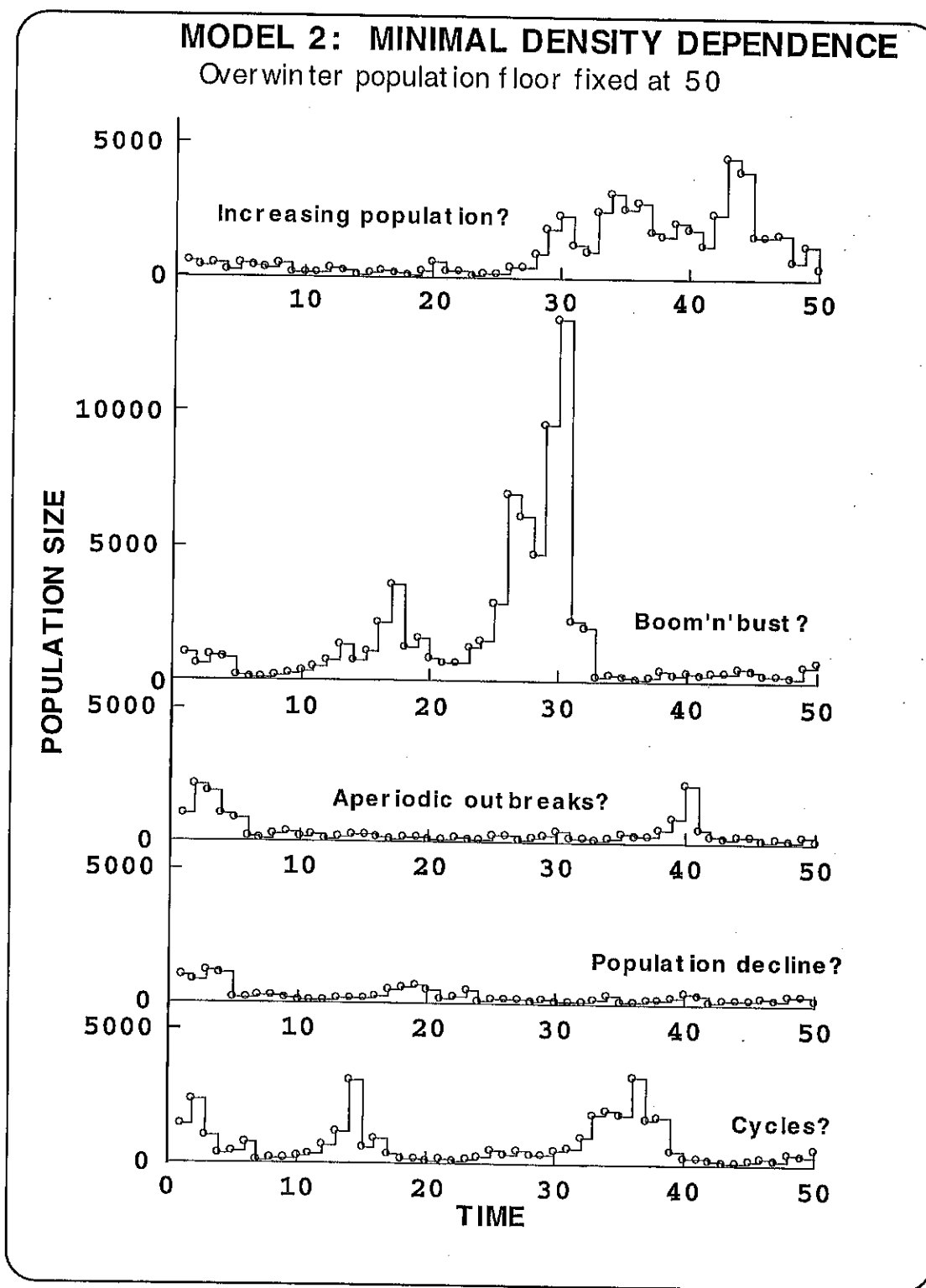
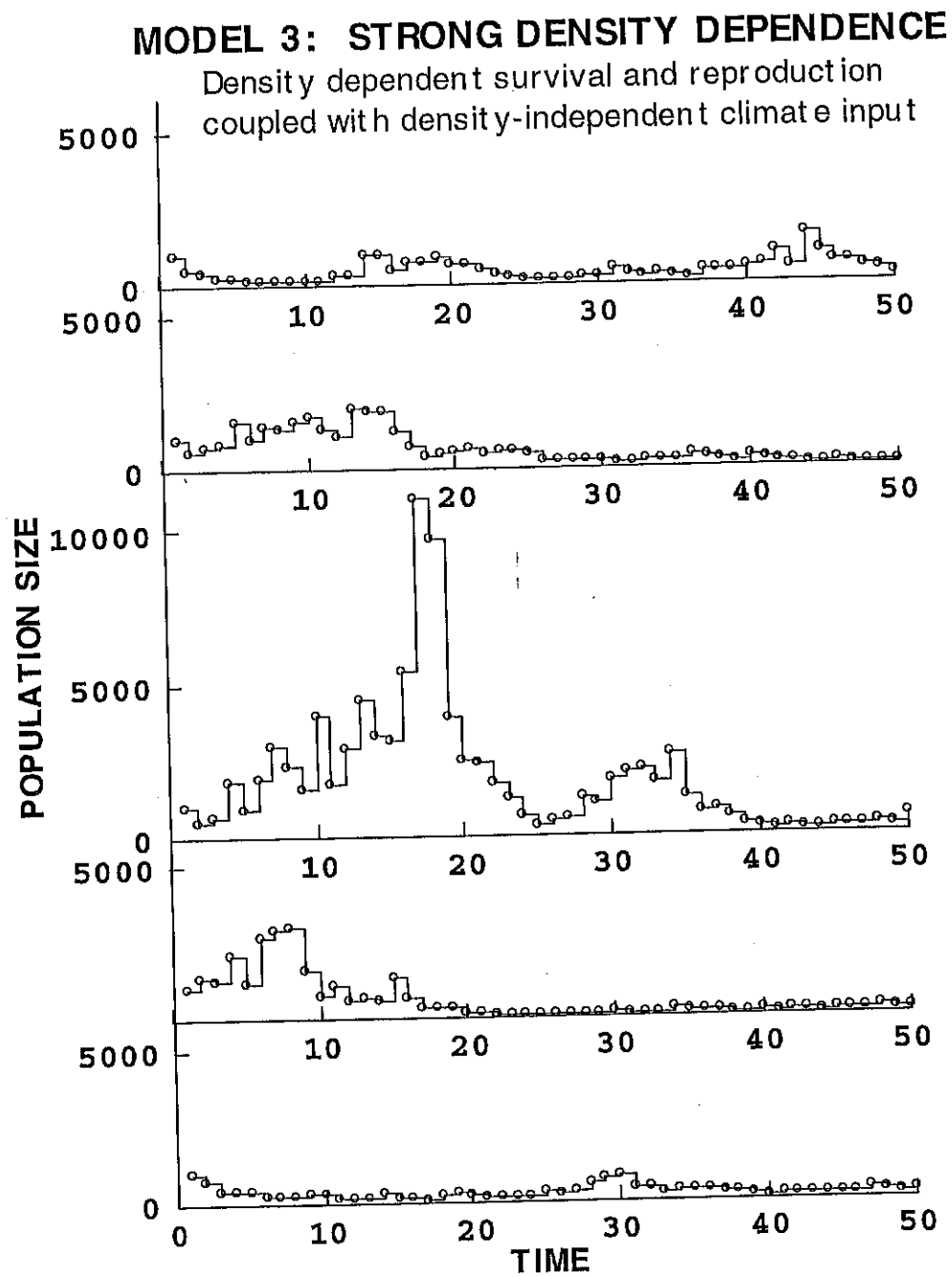


Figure 6c. Simulation model with full density dependence



variation in migration distance or in overwintering site, all potentially dependent on the conditions encountered in any specific year.

4. BIOTIC EFFECTS, INTERSPECIFIC INTERACTIONS

The final point made in this section relates to the potential for interspecific interactions, and their influences on population sizes. Often this comes down to whether population sizes in two or more coexisting species show positive or negative covariation. For example, if two species within a community are mutually strong competitors and both minimally affected by the other species present, there is a good prospect that such influences will be detectable in their breeding population densities. Take, however, the numbers of six "species" over time in Fig. 7. The simple correlations suggest no obvious "interspecific" effects; while almost all are negative, none are significantly so, and "interspecific interactions" therefore would be discounted. The data in this figure, however, are from the 1988 National League West baseball season, with ordinate representing numbers of games won in successive 10-game intervals. These data are shown in the more conventional form in Fig. 8, where the outcome of the 6-team, 28-week competition favors the L.A. Dodgers.

The point is that, where competition is diffuse, as well it might be in communities of generalized insectivorous birds breeding in GTNP, interspecific effects may be difficult to disentangle from breeding population censuses. Long-term census data would make the problem somewhat more tractable, and studies addressing breeding success, given the variable density of potential competitors within the same sites, would also be useful.

Figure 7a. Are these "species" affecting each others' numbers?

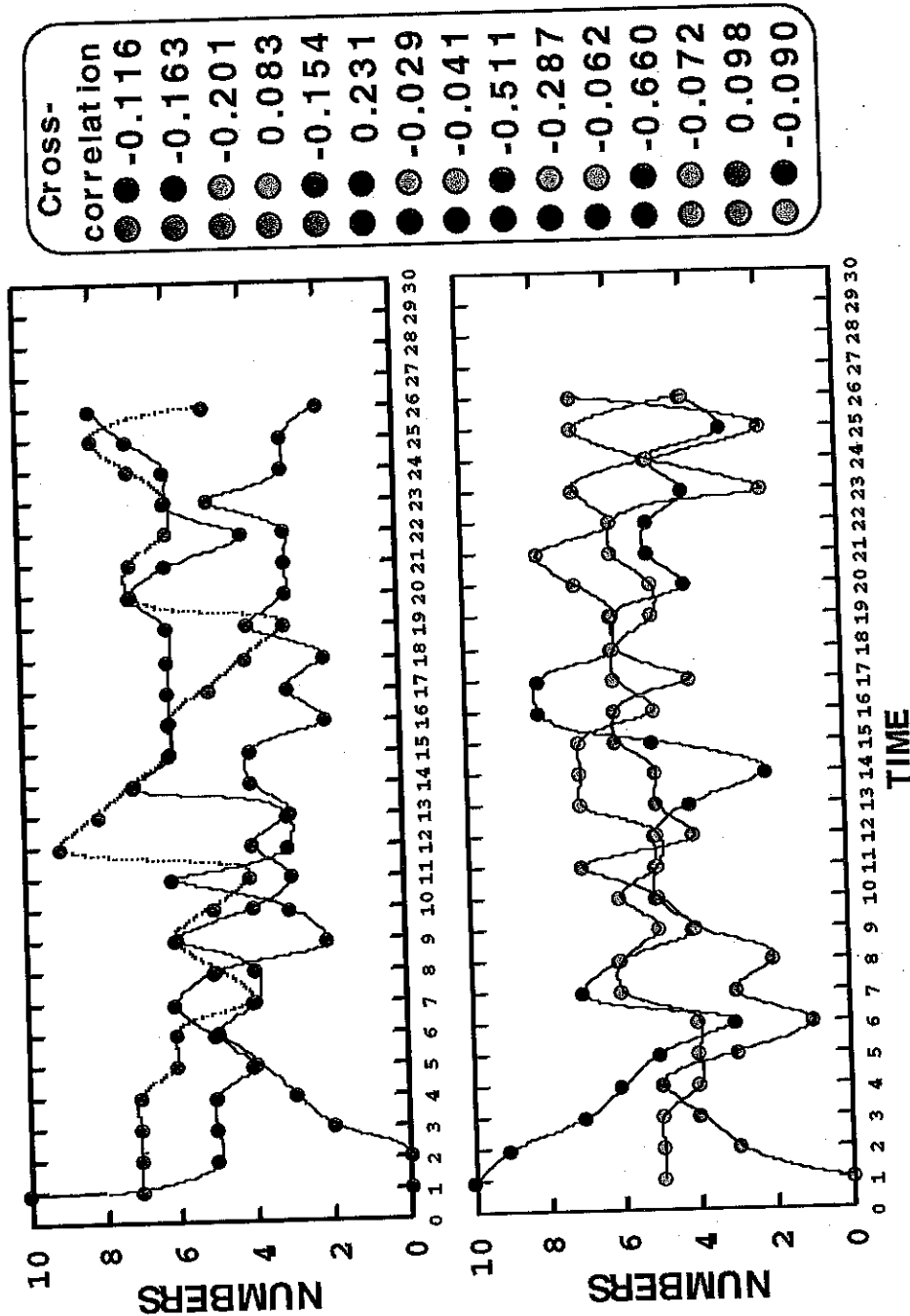
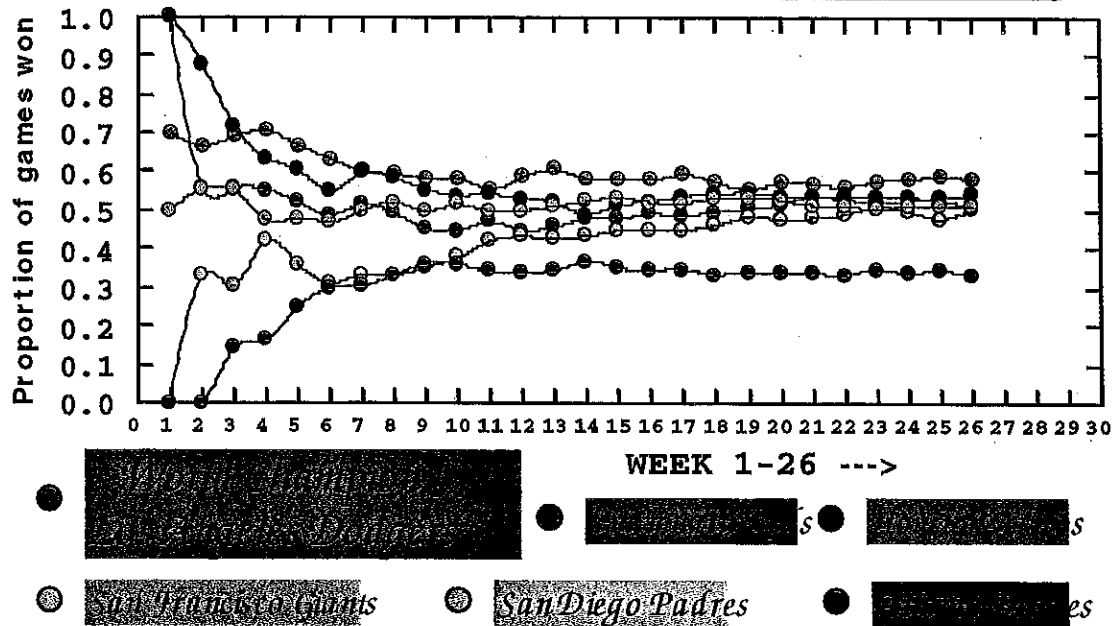


Figure 7b.
Cumulative Scores: National League West 1988



D. GTNP BREEDING BIRD MONITORING PROGRAM: DESIGN CRITERIA

1. PROJECT PERIOD

The funded period of this project extended through the three summers of 1995-1997 inclusive. During this period census protocols were established, monitoring sites selected and mapped, and representative census data collected for all monitoring sites for up to three consecutive breeding seasons. The value of the project as a monitoring program and potential management tool will be realized only in the longer term, if and as the the program is continued in future years and a comprehensive data base for GTNP breeding bird populations is accumulated.

2. HABITAT COVERAGE: NUMBERS AND LOCATION OF SITES

The goals of the project called for monitoring sites in all of the major habitat types within GTNP (see section F, below). Allowing for minimal replication of habitats, it was thought that some 25-30 monitoring sites would be appropriate. The obvious constraints are

a) Number of personnel; the program as it has been configured can be managed by as few as two observers working nearly full time during the season. Whereas as more personnel could census correspondingly more monitoring sites, a program designed for two persons seems a safe and judiciously conservative criterion;

b) Site accessibility; all sites were deliberately chosen for ease of access, in order to minimize observer travel time to and among sites.

3. AVIFAUNA COVERAGE

The monitoring program was designed to cover the widest possible range of breeding bird species. However, some species are inadequately surveyed by the established protocols, and these include most importantly raptors, with large territories and low breeding densities relative to smaller bird species, and nocturnal species such as owls. Some attempt is made to include waterfowl and wide-foraging aerial insectivores (e.g. swallows (see below), but the monitoring program is best adapted to smaller, terrestrial-foraging and territorial (rather than colonial) species. The remaining species group poorly censused by the established protocols is finches Fringillidae, which vary widely in abundance and location within and among years, and many species are non-territorial.

4. CENSUS PROTOCOLS

Census criteria were established as described here, with a view to enhancing census uniformity and replicability, and observer independence. We use a method that is a combination of three techniques, territory mapping, transect counts, and point counts (Bibby et al, 1992). It is termed an "areal count", similar to the "spot-mapping" technique first described by Kendeigh (1944). It maximizes accuracy and the facility with which different observers can duplicate each other's results and observations, while minimizing the work required to plot actual territories and the difficulties with transcribing transect or point census data to real breeding densities.

a) Length of the breeding season; during some years accurate breeding bird censuses might be made over a period as long as six weeks, usually mid-June to the end of July, but often the season is somewhat more abbreviated. Completion of the monitoring effort within as short a

period as possible is desirable, with six weeks as a maximum span. Lowland, open and drier sites can be completed first, as in these the breeding season is more advanced; high elevation sites can be left to later in the season. Within a particular year, breeding seasons may be early in general or late, and adjustments to the census timetable can be made accordingly.

b) Each site should be censused a minimum of three times during the breeding season, with visits spread over at least two weeks. One visit is made early am (600-800h), one later in the morning (800-1100h), and one late afternoon (1500-1800h). The intent of this procedure is to account for potential differences among species in diurnal activity periods.

c) Each census is made with a site map in hand, with most sites on the order of 5 ha in size. With the site map, an observer can always identify his/her position within the site, and locate permanent markers within the site.

d) The observer spends around 2h within the site on each visit.. Day, time, and observer identification are marked on the map sheet. All birds located and identified within the site are marked on the map if singing on territories, listed on the map if moving through the site, or foraging within or over the site but nesting elsewhere. The intent is to confirm identities and derive density estimates of all species that utilize the site.

e) While actual territory boundaries are not plotted, the locations of foraging, nesting and/or singing birds are all recorded on the site map. Densities are then derived from accumulated mapped observations, by drawing up if necessary a species map for each species

found at the site, using the same site map master. By delineating areas consistently used by individual pairs and distinguishing them from areas used by other conspecific pairs, the density of each species can be determined (Bibby et al., 1992, Ch. 3). Mapping the locations of individuals, even approximately, minimizes difficulties stemming from duplicated records (multi-listing). Since all parts of the site are covered slowly and carefully, rarer and/or more secretive species are unlikely to be overlooked, and are scored proportionately with common species.

f) For each census/visit, species are tallied and density estimates appended in units of numbers of breeding pairs. In species for which a 5 ha site is a small fraction of a larger territory, for non-territorial species, for smaller species nesting offsite and including a fraction of the territory within the site, reasonable estimate are made of the contribution of the e.g. 5 ha site to the requirements of the pair/species in question. Densities ultimately recorded in the data set are the averages of the two highest counts of the several made at a site during the season.

g) Each site is visited at least once by each observer, such that inter-observer differences (e.g. in expertise or ability) are at least averaged over sites.

5. DATA FORMAT

Data collected in the monitoring program contribute to a 3D matrix: census year (Y) by species (B) by site (S), with elements of numbers of breeding pairs per hectare. The data matrix is currently 3Y (for most sites) x ca. 150B x 30S; as monitoring coverage is extended in future years, a variety of summary statistics will be extracted from the

within
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where it
is most
important

data matrix, such as population trends of various species (YxB), bird densities among sites (BxS), patterns of habitat use among years (YxBxS), etc.

Two additional sorts of information will aid in the interpretation of the data matrix.. One is weather data, summary statistics of weather variables that impact on-site conditions, such as winter snowfall, spring precipitation and temperatures, and/or others that can be identified a posteriori as the data matrix enlarges. Secondly, measures of more direct on-site influences will be valuable, such as insect densities from Tanglefoot traps, water levels in ponds, grass density in fields, etc., all of which may influence breeding bird densities within a particular year.

E. GTNP AVIFAUNA: OVERVIEW

1. SPECIES LIST

Some 300 bird species have been recorded in Jackson Hole, about the same as in Yellowstone National Park (YNP; McEneaney 1996). Of these, some 270 species have been recorded in GTNP (Johnsgard 1986, Raynes 1995), around 250 in spring-summer, and about 175 species (90 passerines, 85 non-passerines) breed within the park. Common and Latin names of bird species so far recorded on the monitoring sites are given in Appendix A.

2. RARE SPECIES; BREEDING RANGES

A good number of species that have been recorded as breeding within the park, or else may be classed as likely breeding species (but breeding is unconfirmed), are rare. Rare breeding species fall into several distinct categories, as discussed below. In this section I refer largely to my

own observations, but cite Johnsgard (1986) who labels rare confirmed breeding species as R*.

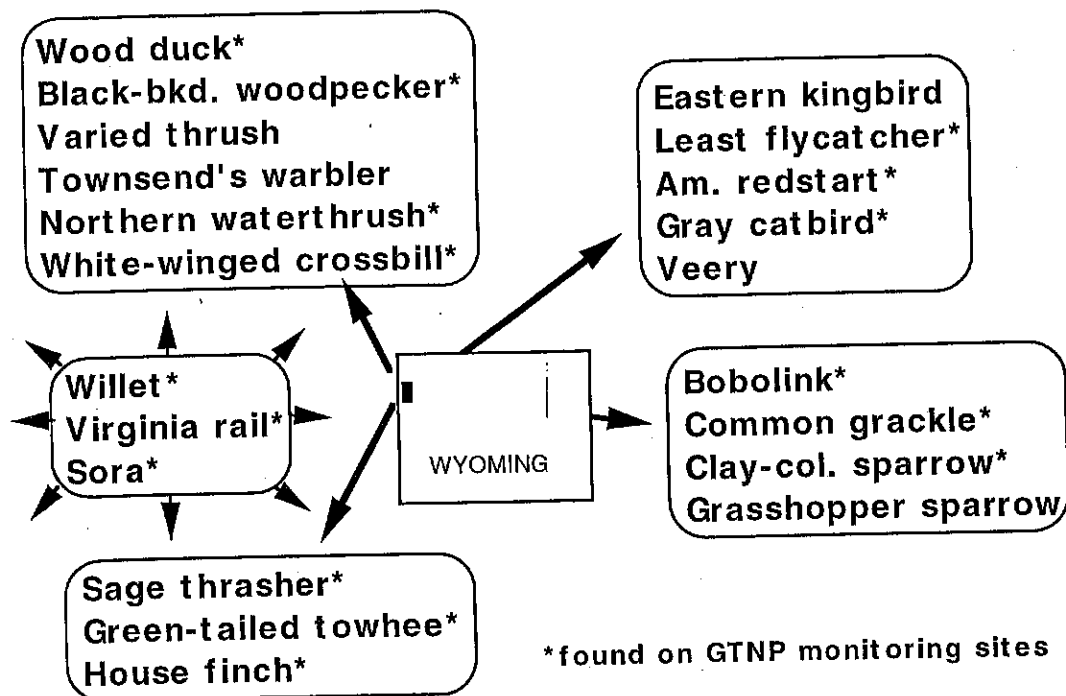
a) Labeled rare because species have large territories or are not easily detected. Several species of raptors and owls are designated R* in Johnsgard, likely for this reason; they are likely no rarer in GTNP than in other sites of prime habitat.

b) Rare because suitable breeding habitat is rare. This might explain why Common loon, grebes, ducks and shorebirds are labeled R in Johnsgard. Some species of prairie ducks and shorebird, species commoner in northerly glacial lakes, and several grassland birds fall into this category.

c) Many species are on the edge of their geographic ranges in GTNP. Examples of such species are given in Fig. 8; for each species in the table, its Johnsgard abundance/breeding code is included here (U: uncommon; R: rare; V: vagrant). Species in the figure that have been detected on GTNP monitoring sites are identified with an asterisk there.

Some species' ranges reach GTNP from the east and northeast (Eastern kingbird [O], Least flycatcher [V], American redstart [O], Gray catbird, Veery [O], et al.), while others are more typically plains birds that become common immediately east of the Rocky Mountains (Bobolink [R], Common grackle [O], Clay-colored sparrow [R*], Grasshopper sparrow [V]). Further north in the Rocky Mountains several species whose breeding populations in GTNP are at best marginal (Wood duck [R], Black-backed woodpecker [O], Varied thrush [V], Townsend's warbler [R], Northern waterthrush [R], White-winged crossbill [V]) become common, and south and southwest of GTNP, particularly into the Great Basin, Sage thrasher [O*] and Green-tailed towhee [C] are common while House finch [V] becomes

**Figure 8. SOME GTNP BIRD SPECIES ON
THE EDGES OF THEIR BREEDING RANGES**



abundant in the dry and open Ponderosa pine forests unrepresented in GTNP but plentiful to the south. Some species that are rare breeders in GTNP but are not at their range boundaries there are also listed: Willet [R], Virginia rail [V; Fall], and Sora [O*].

Of the 21 species listed in Fig. 8, >75% have occurred on GTNP monitoring sites. Some undoubtedly breed in GTNP on a regular basis but not every year, and their use of GTNP seems a response to suitable conditions that occur irregularly. For example, Northern waterthrush and Virginia rail have bred in the Wet Willows monitoring site (#10) several times in the 1990's, in wet, cool years. The same sorts of conditions also bring Gray catbirds to Aspen-willow edge (site #11) and our Dry Willows sites (#'s 9, 11), and Least flycatchers to aspen or cottonwood sites (#'s 14, 15). Other species listed breed practically every year, but in rather scarce habitat (e.g. Sora in wet, brushy sedge marshes, Sage thrasher in tall sagebrush, and Bobolink in tall, forb-rich grassland in the Elk Refuge, site # 3).

Two sparrows deserve further mention. Clay-colored sparrow was a common breeding species in GTNP in the 1960's and early 1970's, but has been essentially absent from GTNP during most of the 1990's. There has been no recorded change in the species' density in the center of its breeding range, essentially the brushy northern plains, during this 30 yr period, and in GTNP at the edge of its range its occurrence appears to be the result of local conditions. The earlier period during which it was common was a drier one; in two years during the 1990's it has been seen and heard singing in GTNP, including in site #8 in 1997, a relatively dry summer. Apparently the species utilizes habitats at the edge of its range only during years of particularly suitable local conditions. Grasshopper

sparrow is a species that was listed as a regular breeder in the 1930's when the park was established, but I have never seen it in GTNP. Possibly grazing pressures on the local grasslands have prompted its retreat east to typical breeding habitats in the mixed-grass plains. Notably, both sparrows are similar to Savannah sparrow in habitat requirements, and this species is abundant within GTNP.

It is considered to be a fortunate circumstance that so many species are at the edges of their breeding ranges in GTNP, for here it is likely that populations will be far more sensitive to year-to-year variations in local conditions than would be the case in the center of their breeding ranges. Several of the 30 monitoring sites were selected in habitat types specifically to detect the presense of rare breeding species when and if they occur within GTNP. Thus the opportunities to determine which local factors correlate with GTNP breeding in these marginal species are several.

3. MIGRANTS VS RESIDENTS

Given the severity of the GTNP climate, particularly its strong seasonality, it is not surprising that a high proportion of the breeding bird species are migratory. Under 40% of the breeding non-passerines can be found in Jackson Hole throughout the winter, and many of these at much reduced densities. Under 30% of the passerines remain in the park during the winter, and again many of these at reduced densities indicating at least local movements to more benign habitats. The residents are those species that typically overwinter at high latitudes in the Holarctic region, including corvids, sittids, and fringillids. Among the several breeding species that are marginally resident, presumably in response to the severity of the

winter, are Song sparrow, American robin, Red-winged blackbird and Dark-eyed junco.

Note that there is no compelling reason that migrant bird populations should be expected to be more variable or less predictable on the breeding grounds than those of resident birds, or vice versa. From first principles, selection is expected to act on migration or residence strategies to maximize overwinter survival, favoring further migration if less produces lower survival and less migration if increased residence enhances survival; overall, overwinter survival should not differ greatly among the diverse strategies available to temperate breeding birds.

4. PRIOR RESEARCH IN GTNP; POPULATION TRENDS

Here I summarize the considerable amount of earlier work that constitutes a basis for the monitoring program, with a brief historical review of some known or suspected trends in bird populations. Between the establishment of the park (1929) and its reaching the present-day configuration (1950), bird status surveys were conducted 1933-37 (Washington, D.C., 1937). Salt (1957) reported on habitat selection and relative abundances of Lincoln's, Fox and Song Sparrows, and subsequently his site (Wet Willows site #10) was studied intensively by MLC in the late 1960's and into the 1970's (Cody 1974), and again 1991-1994 (Cody 1991, 1992, 1993, 1996, 1997). A second site (Grass-sage site # 4) has likewise been studied by MLC since the 1960's, and the three aspen census sites (#s 12-14) were first censused by D. Flack in the 1960's (Flack 1976). Thus at several monitoring sites there are bird population data extending back > 25 years.

Surveys from the 1930's provide some qualitative data for comparison with present-day estimates of bird occurrences and densities, and give a perspective of over half a century on changes in the GTNP avifauna. Seven species were listed in the 1930's GTNP survey (Table 1) which we have not seen within GTNP (in 30 yrs; MLC), although several would be expected to occur at established monitoring sites (e.g. Horned lark, Eastern kingbird, and possibly Grasshopper sparrow). Several of these species are well known from the immediate vicinity of GTNP, and it is hard to judge whether the earlier records were from within actual park boundaries. Judging from the status accorded to these species at present (Raynes and Wile 1994), some have apparently declined in abundance over the last half century, notably several species typical of grasslands, open or brushy country.

A further 9 species are listed in Table 1 which were not listed in the 1939 survey, have not been found in our recent surveys, but are accorded rare or occasional breeding status by Raynes & Wile (1994). Other unlisted species in the early survey include some species that are now common breeding birds in the park (e.g. Wilson's warbler), but it is difficult to decide to what to attribute their early omissions (e.g. oversight, typographical error, true absense). Some earlier listed species are now apparently much more common than they were in the 1930's, a list that includes White-crowned sparrow, Brown-headed cowbird, and European starling. These and several others listed than appear to have increased moderately to dramatically in abundance (including Cliff swallow, Sandhill crane, Green-tailed towhee, Lincoln's sparrow, Common yellowthroat, Black-billed magpie, ?Wilson's warbler, MacGillivray's warbler, Dusky Flycatcher, Swainson's thrush, and White-breasted nuthatch). Overall,

TABLE 1: Past and present status of some rarer bird species of GTNP: locations, habitat/site Incidences, and other observations.

<u>Species</u>	<u>Status¹ 1937²</u>		<u>1966-97</u>
Sharp-tailed grouse	r	U	S Loop, S of Jackson only
Lewis woodpecker	o	"R"	NS ³
Say's phoebe	r	C	↓↓↓; nr. site#3 in Jackson
Western kingbird	r	U	S of Jackson only (S Loop)
Eastern kingbird	o	"R"	NS
Horned lark	c	F	↑↑NS; expected in several monitoring sites
Grasshopper sparrow	?	U	NS
Winter wren	r	--	NS
Veery	o	--	NS; Blacktail Butte record
Loggerhead shrike	r	--	NS
Solitary vireo	r	--	NS; cottonwoods?
Tennessee warbler	r	--	NS
Townsend's warbler	o	--	One record, site #19
Rufous-sided towhee	r	--	One record, site #26
Lark bunting	r	--	NS; ?Elk Refuge
Northern oriole	o	--	NS; cottonwoods?

¹From B. Raynes & D. Wile, "Finding the Birds of Jackson Hole", 1994, in which "r" indicates "rare", "o" = "occasional", "c" = "common".

²"1937" indicates the USNPS Checklist of the Birds of the National Parks, Washington 1937. Pt 10783A: GTNP. The usage here is: "A" = "abundant", "C" = "common", "F" = "fairly common", "U" = "uncommon", and "R" = "rare". "--" indicates species not mentioned in early checklist; " " around letter indicate my interpretation of comments on status in 1937 checklist.

³NS = Not Seen by MLC, 1960's-1997

these comparisons provide some hints as to what long-term changes may have occurred in GTNP, and indicate which species are of particular interest to the monitoring program in that regard.

F. GTNP HABITATS

1. AREA, ELEVATION, VEGETATION

Grand Teton National Park is an ideal locale for monitoring breeding bird populations, since it combines relatively small area (ca. 1300 km²) with easy accessibility and a complete range of habitats representative of the GYE. Elevations in the park encompass the range from the Snake River bottomlands at 1900 m to some of the higher peaks in the region (4173 m), together with the arctic-alpine habitats in their vicinity. The topographical relief in the park is unmatched in other areas of comparable size, and this produces a range of habitats that is unparalleled in other regions of comparable area in the central or northern Rockies. The evolution of this unique landscape is well described in Love and Reed (1968), and Knight (1994) places the region in a geological as well as ecosystem perspective.

A broad range of habitats characterizes GTNP. The Snake River bottomlands are patchily forested, with blue spruce (Picea pungens), cottonwoods (Populus angustifolia and P. trichocarpa), and lodgepole pine (Pinus contorta). Interspersed among the forest patches are many marshy oxbows, ponds and associated willow (Salix spp.) flats. Drier forb-meadowland and wetter sedge-grassland also occur throughout the lower elevations. The upper riverside benches and floor of Jackson Hole are largely sagebrush (Artemisia tridentata and A. cana)/grassland (Festuca spp. and Poa spp.) flats, with a substantial bitterbrush component (Purshia

tridentata) in some areas. Lower hillsides and morainal slopes around the Hole are largely wooded with lodgepole pine (Pinus contorta), with some areas also supporting Douglas fir (Pseudotsuga menziesii). Denser forests of Engelmann spruce (Picea engelmannii) and subalpine fir (Abies lasiocarpa) become predominant somewhat higher and especially in the foothills at the eastern base of the Teton range. Closed and open stands of whitebark pine (Pinus albicaulus) occur above 2400 m elevation. Aspen (Populus tremuloides) forms extensive stands on the foothills of the Gros Ventre Mountains that border the valley to the east, and occur elsewhere in landslide or other disturbed areas. Above timberline (ca. 3500m) the arctic-alpine zone is vegetated largely by perennial, rosette-forming forbs.

2. MONITORING SITES

We have established a total of 30 monitoring sites within (28 sites) or immediately adjacent to (2 sites) GTNP. The sites are listed in Table 2, and span a range of elevations from 1900-3000m, and cover the park over practically its full N-S and E-W extent. Fig. 9 indicates the locations of the sites within or near GTNP.

Sites 1-3 are in grassland; site 1 (Wolf Ranch) is heavily grazed by cattle for several weeks in the summer, sites 2 (Jackson Lake Junction -JLJ) and 3 grazed by native ungulates, site 3 in the National Elk Refuge and one of the two sites outside GTNP. Site 4 (JLJ grass-sage) is a long-term monitoring site (since the 1960's). Site 5 is established half and half across the edge of the Antelope Flats 1994 sagebrush burn, and includes both burned (site 5B) and unburned (site 5U) sage. Site 6 (Airport sage) is tall sagebrush, site 7 (Two Ocean Lake -2OL) a brushy forb meadow, and site 8 (Triangle X Ranch) is scrubby aspen. Three sites (9-11) have a dominant

TABLE 2.SITE LIST

NPS FINAL REPORT			TABLE 2.		
LIST OF MONITORING SITES: #'S 1 - 30					Area
#	Site Name	Habitat	Yr.Establ	Elev	(ha)
1	Wolf Ranch	Grazed meadow	1994	2045	7.5
2	Jackson Lake Junction	Grass-sedge meadow	1992	2053	10.0
3	Elk Refuge	Wet meadow	1994	1895	8.4
4	Jackson Lake Junction	Grass-sagebrush	1966	2043	4.7
5B	Antelope Flats	Sage burn	1995	2000	7.5
5U	Antelope Flats	Sage unburned	1995	2000	7.5
6	Jackson Hole Airport	Tall sagebrush	1992	1956	6.0
7	Two-ocean Lake Rd.	Forb-meadow	1993	2158	4.6
8	Triangle X	Aspen-scrub	1996	2090	4.6
9	RKO/Snake R. Bottoms	Dry willow flats	1992	2003	6.0
10	Jackson Hole Junction	Wet willow flats	1966	2049	3.3
10S	RMNP Onahu Ck	Wet willow flats	1885	2450	6.5
10N	GNP Coonsa Ck	Wet willow flats	1996	1636	10.0
11	Oxbow Bend	Willow-aspen	1992	2040	7.2
12	Elk Ranch West	Low aspen woodland	1968	2109	6.5
13	Elk Ranch East	Mid aspen woodland	1968	2152	5.0
14	Cow Lake	Tall aspen woodland	1968	2091	5.0
15	Spread Creek	Cottonwoods	1992	2085	6.0
16	Schwabacher Landing	Cottonwoods	1992	1988	7.5
17	Lower Granite Canyon	Lodgepole-aspen woodland	1995	1965	5.3
18	Timbered Is. Moraine	Lodgepole-spruce	1994	2060	5.0
19	AMK Ranch	Lodgepole pine forest	1991	2055	6.0
20	Taggart Lake	Successional lodgepole	1995	2090	5.6
21	Signal Mountain	Lodgepole-fir forest	1992	2258	7.0
22	Spaulding Bay	Douglas fir-spruce forest	1995	2121	5.8
23	Lizard Creek	Lodgepole-spruce-fir	1992	2195	4.8
24	Bradley Lake	Spruce-fir-lodgepole forest	1995	2180	6.0
25	Jenny Lake	Spruce-fir forest	1992	2197	5.5
26	Upper Granite Canyon	Spruce forest	1994	2365	4.0
27	Rendezvous Mountain	L'pole-whitebk pine-Subalp. fir	1994	2970	5.0
28	Cody Bowl	Arctic-alpine tundra	1994	2900	20.0
29	Heron Pond/Swan Lk	Waterfowl ponds survey	1995	2052	
30	Blacktail Ponds	Aerial foragers survey	1996	2040	

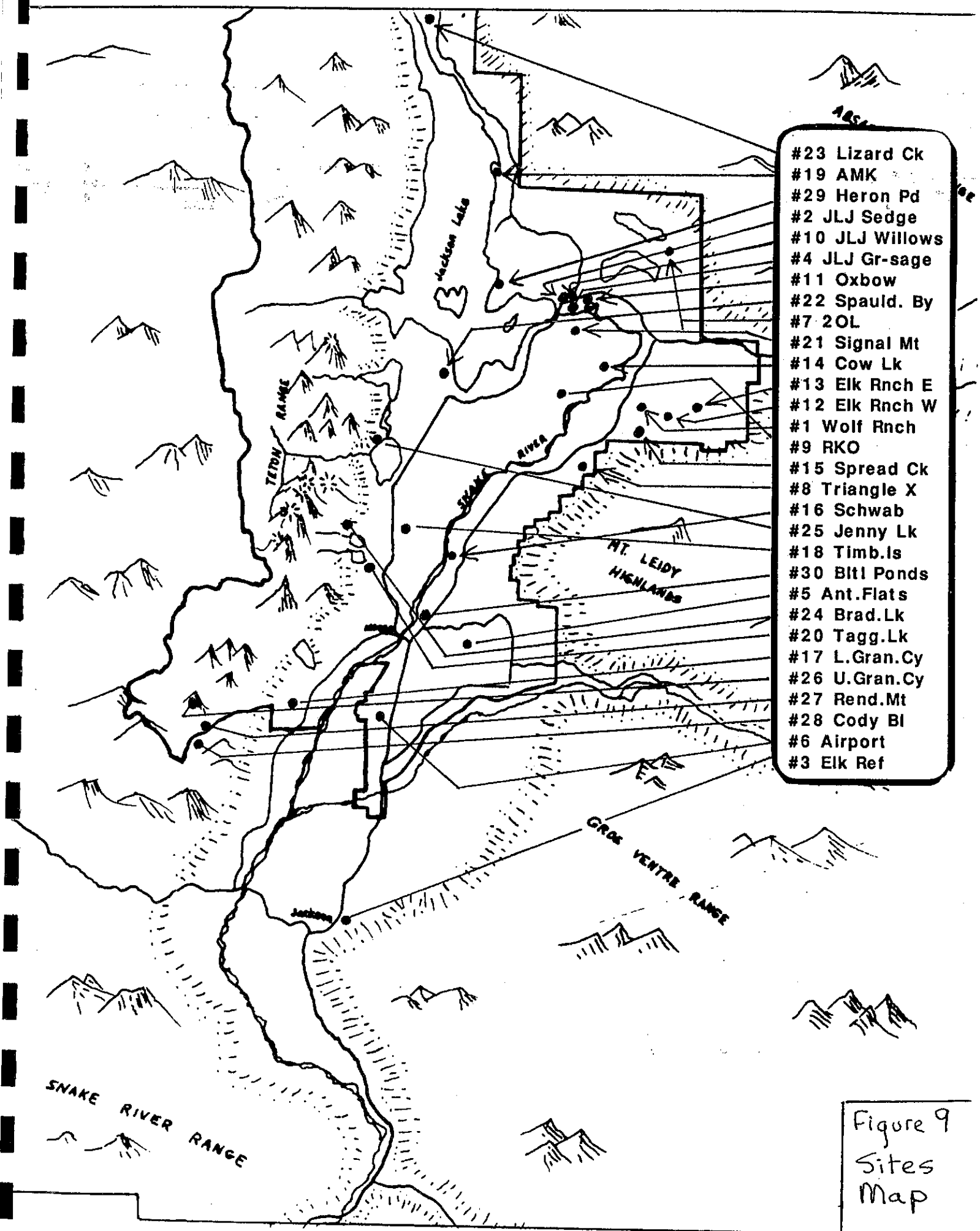


Figure 9
Sites
Map

willow component, with site #9 a relatively dry willows area (RKO Ranch), site #10 the fabled Wet Willows site (JLJ), and site #11 the Oxbow site first used by G. Salt (see above), with some aspen groves. *Site 10?* p. 25

Three aspen sites (12-14) are areas used originally by D. Flack (see above), with low aspens (site #12: Elk Ranch West), mid-sized aspens (site #13: Elk Ranch East), or tall aspens (site #14: Cow Lake). Sites #15 (Spread Creek) and #16 (Schwabacher Landing) are cottonwoods, site #17 (Lower Granite Canyon) is mixed aspen-conifers, and sites 18-21 are situated in lodgepole pine forest. They all differ to some extent, in that site #18 (Timbered Island) is an isolated forest patch, site #19 (AMK Ranch) is in contiguous forest, site #20 (Signal Mountain) somewhat elevated and isolated, and site #21 (Taggart Lake) is within a recent (1988) burn and undergoing succession.

Other conifer sites are #22 (Spaulding Bay) with a large douglas fir component, site #23 (Lizard Creek) has much Engelmann spruce, site #24 (Bradley Lake) is mixed lodgepole pine-fir-spruce, and site #25 (Jenny Lake) has some of the tallest old-growth timber in the park, including douglas fir and Engelmann spruce. Site # 26 (Upper Granite Canyon) is located within pure spruce forest, while site #27 (Rendezvous Mountain) is mixed whitebark pine-lodgepole pine-subalpine fir. Site #28 is located nearby, in Cody Bowl just outside the park boundary, and represents the alpine tundra habitat.

The last two sites are included specifically to monitor wildfowl populations (site #29: Heron Pond and Swan Lake) and aerial foragers (swallows; site #30, Blacktail Ponds) respectively. Census protocols for these last two sites differ from those at the other 28 sites (see above). In addition to these 30 GTNP sites, two additional sites are listed and included

in the monitoring program. These duplicate the Wet Willows site (#10) to the north in Glacier National Park (GNP), and to the south in Rocky Mountain National Park (RMNP). These sites are listed as #'s 10N, 10S, and further discussed below (section G.5).

Details of the 30 monitoring sites, including location, permanent markers, site maps, and notes on vegetation are given in Appendix B. Photographs of sites are also provided.

G. ANALYSES

1. MONITORING SITES

Established monitoring sites have been assessed and classified by vegetation structure. At each site a "foliage profile" has been measured, a plot of vegetation density against height above ground. Measurements were made at 5 haphazardly selected points within each site, and in four orthogonal directions at each point. Thus for each of $n=20$ measurements, distances are estimated at which a board will first become 1/2 covered with vegetation as it is moved away horizontally from the observer at a certain fixed height. The reciprocals of these distances measure vegetation density. As the board moves up through the vegetation into the open space above, 1/2 covered distances tend to infinity and their reciprocals to zero. These estimates are made at fixed heights above the ground: 0.15 m (0.5'), 0.30 m (1'), 0.60 m (2'), 1.20 m (4'), 2.12 m (7'), 3 m (10'), 4.5 m (15'), 6 m (20'), 7.6 m (25'), 10.6 m (35'), 15 m (50'), 20 m (65'), 24.25 m (85'), 30 m (100'), and thereafter at additional 7.6 m (25') intervals as required to clear the top of the vegetation. Mean densities are computed for a given height above ground level, and these means plotted against height to give the foliage profile.

Foliage profiles for monitoring sites are shown in Fig. 10. The area under the foliage profile is a measure of the total vegetation at a site, and the areas between certain height intercepts (<0.3 m, 0.3-0.6 m, 0.6-1.2 m, 1.2-3 m, 3-6 m, 6-10.6 m, 10.6-15 m, 15-20 m, 20-30 m, and >30 m) are used as variables (A1-A10; see Table 3) in a factor analysis to describe site interrelations in terms of vegetation structure..

A depiction of the sites in the plane of the first two principal components is shown in Fig. 11a,b. From the figure, it is easy to distinguish the wetland sites, grassland and grass-sage, aspen, cottonwood and conifer forests.

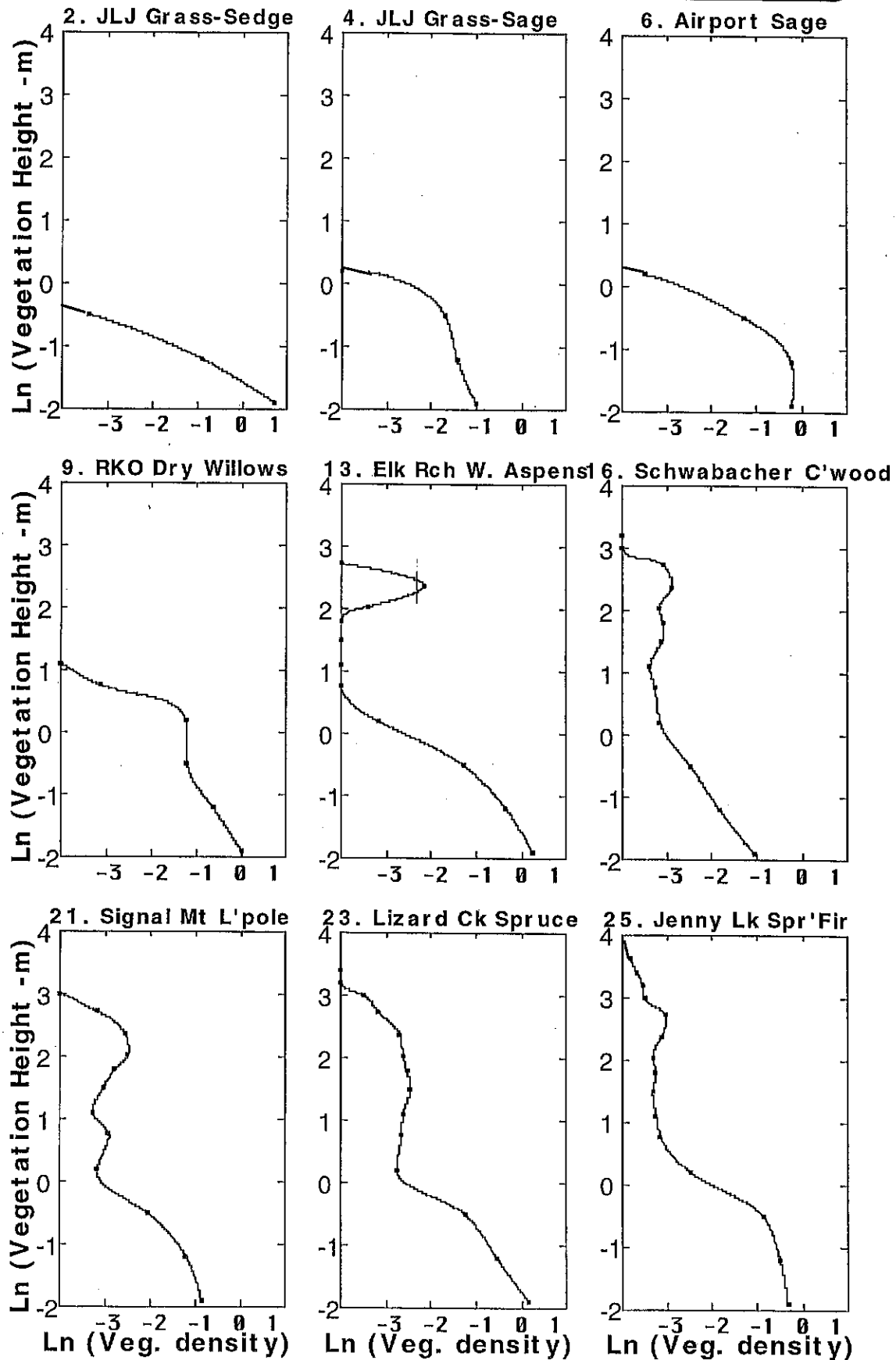
Note that vegetation structure at most of the monitoring sites cannot be considered permanent and unchanging. There are many disturbance factors that change vegetation structure, conspicuous amongst which are fire and storms (e.g. blowdowns) in woodland and forest, and flood and drought in wetland sites. Successional pathways are shown in Fig. 12. Note the expected shifts in vegetation structure on the two recently burned sites (#s 5, sagebrush; 20, lodgepole pine forest).

2.. CENSUS RESULTS

a. Species Summaries of bird species censused on the monitoring sites are given in Appendix C, in terms of densities in pr/ha. No claim is made for accurate density figures of larger species, which are not well monitored on sites in the size range 5-10 ha. For such larger species (e.g. corvids, raptors, grouse, shorebirds, anatids, etc) the census results are more akin to presense/absense records.

Nearly 150 species are recorded on the monitoring sites in toto (Appendices A, C). Most sites from willows to forest support 20-30

Figure 10. Foliage Profiles of Some Monitoring Sites



TAB.3.PROFILES

NPS FINAL REPORT										
TABLE 3. VEGETATION PROFILES AREAS OF MONITORING SITES										
SITE/AREA	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
1:Wolf Rnch	1.089	0.219	0.006	0	0	0	0	0	0	0
2:JLJ Sedge	1.905	0.967	0.345	0	0	0	0	0	0	0
3:Elk Refuge	1.327	0.360	0.121	0	0	0	0	0	0	0
4: Grass-sage	0.635	0.356	0.286	0.025	0	0	0	0	0	0
5:Ant.Fl.burn	0.691	0.269	0.061	0	0	0	0	0	0	0
5:Ant.Fl.unbrn	0.725	0.374	0.189	0.012	0	0	0	0	0	0
6:Airport sage	0.693	0.550	0.457	0.104	0.022	0	0	0	0	0
7:20L meadow	0.997	0.446	0.164	0.020	0	0	0	0	0	0
8:TriX aspscrul	1.351	0.625	0.554	0.501	0.365	0.117	0.014	0	0	0
9:RKO DriWill	1.509	0.884	0.69	0.332	0.034	0	0	0	0	0
10:JLJ Willow	1.298	0.621	0.860	0.805	0.129	0	0	0	0	0
11:Oxbow W/A	1.518	0.778	0.583	0.645	0.405	0.281	0.061	0	0	0
12:LowAspen	0.592	0.196	0.152	0.148	0.399	0.349	0.144	0.024	0	0
13:MidAspen	0.89	0.347	0.26	0.274	0.155	0.781	0.939	0.29	0	0
14:CowLkAsp	0.654	0.260	0.186	0.029	0.069	0.657	0.931	0.189	0	0
15:Spr.Ck.Cot	0.181	0.125	0.129	0.17	0.362	0.629	0.705	0.461	0.167	0
16:Schwab.Cot	0.424	0.210	0.247	0.354	0.481	0.980	0.901	0.452	0.166	0
17:L.Gran.Cyn	0.709	0.359	0.286	0.356	0.606	0.813	0.655	0.373	0.172	0
18:TimberMt	0.329	0.133	0.180	0.411	0.689	0.684	0.383	0.241	0.172	0
19:AMK.Ldgp	0.609	0.147	0.134	0.339	0.482	1.115	0.805	0.480	0.289	0
20:TaggartLk	0.536	0.251	0.293	0.259	0.013	0	0	0	0	0
21:Signal Mt	0.975	0.438	0.346	0.490	0.679	1.025	1.057	0.634	0.177	0
22:Spauld.Bay	0.964	0.402	0.246	0.373	0.733	1.172	1.040	0.853	0.965	0.110
23:Lizard Ck	1.231	0.524	0.365	0.611	1.015	1.226	0.903	0.506	0.363	0.013
24:Bradley Lk	0.758	0.574	0.622	0.496	0.909	1.173	0.838	0.632	0.659	0.013
25:JennyLake	1.024	0.532	0.495	0.632	0.851	1.049	0.800	0.577	0.855	0.278
26:Up.Granite										
27:Rendezvous										
28:Cody Bowl	0	0	0	0	0	0	0	0	0	0
29:Heron/Swa	0	0	0	0	0	0	0	0	0	0
30:Blackt.Pond	0	0	0	0	0	0	0	0	0	0

Figure 11. Factor Analysis and Structural Relations among Monitoring Sites

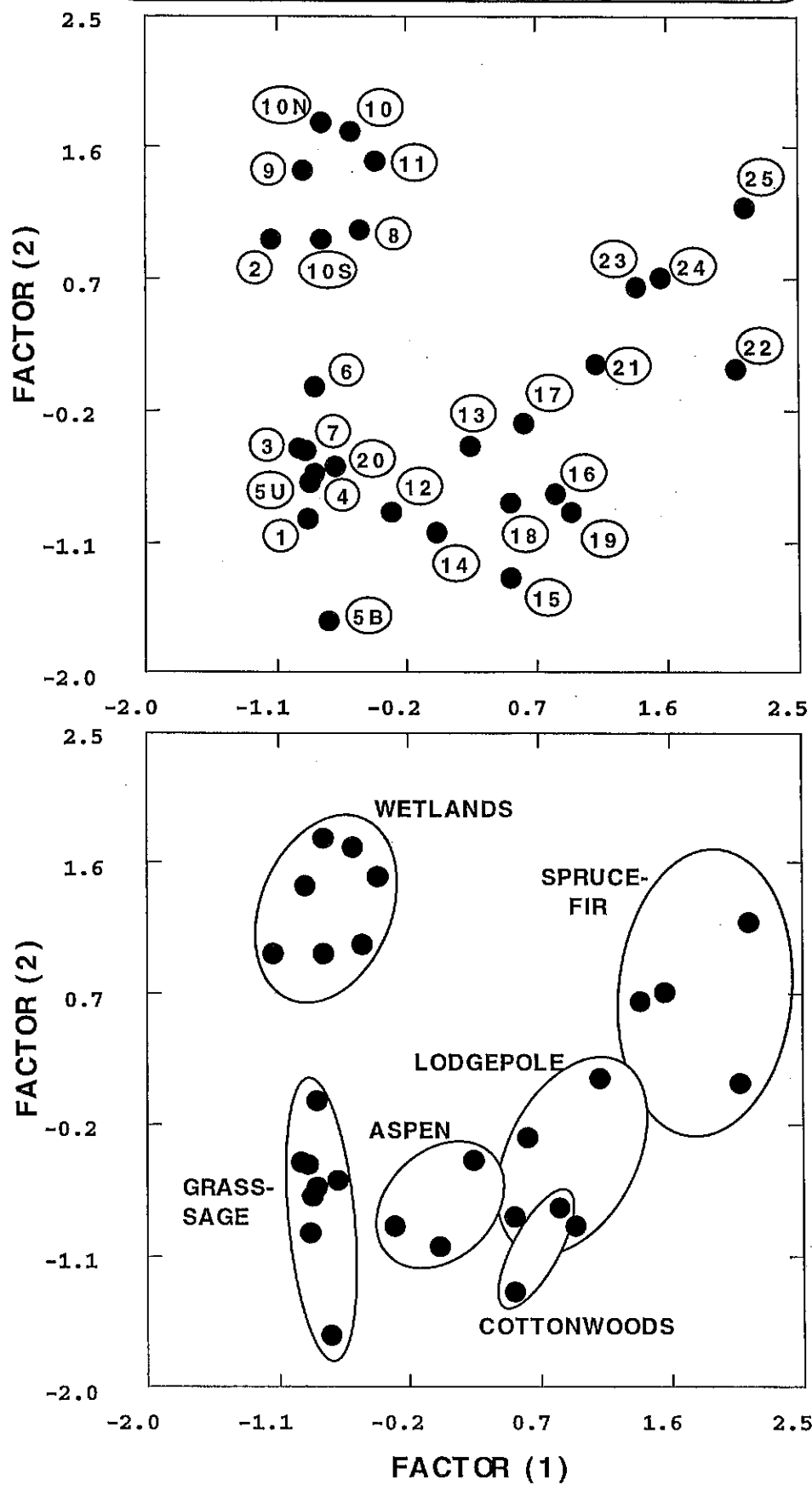
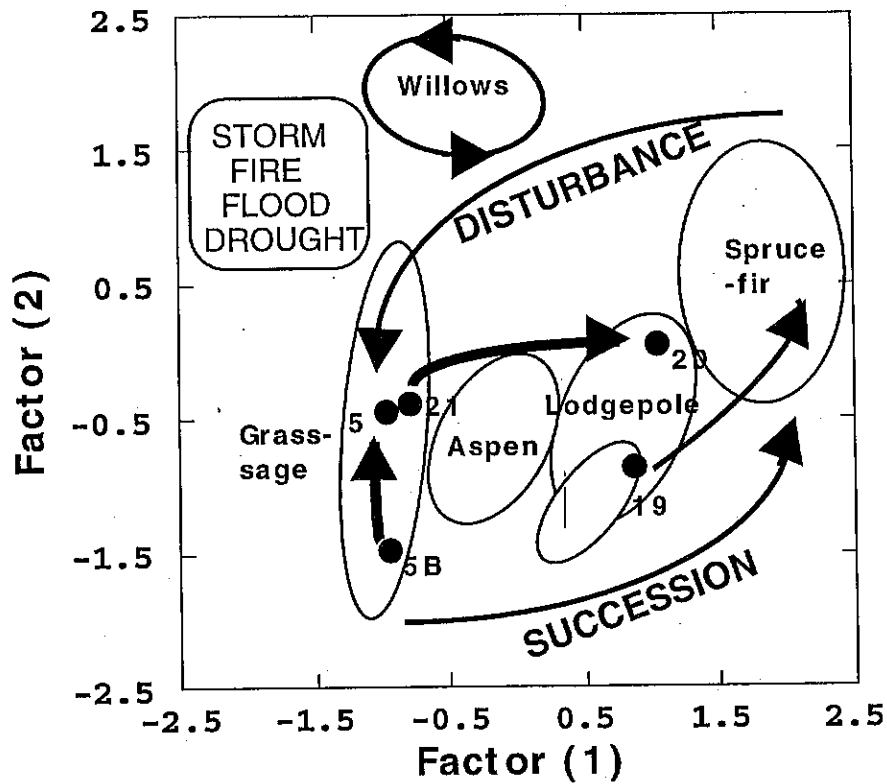


Figure 12. Potential long-term instability factors influencing monitoring sites



species, and the taller woodland and forest sites closer to 30 breeding species. Fig. 13 shows the distribution of species numbers over sites. Lower counts were recorded in 1995, in comparison to which species numbers were nearly uniformly higher in both 1996 and 1997. Species number appear less variable in site #'s >20, i.e. in taller conifers; the most conspicuous contributor to non-uniformity in the trend of species over sites is the smaller species numbers recorded in dry sagebrush sites, #'s 4-6.

b. Densities Breeding bird densities are generally around 2-6 pr/ha in grasslands. 2-3 pr/ha in sagebrush, and 6-12 pr/ha in most other sites, with an obvious pike of high density in the Wet Willows (site #10; see Fig. 14). In general total density parallels species numbers over sites ($r = 0.76$). In 1995 overall densities were lower across sites (as were species numbers), but similar between 1996 and 1997 (Fig. 14). Both species numbers (richness) and total bird density correlate with vegetation height and foliage diversity over the profile; while significant, neither relation is compelling, as no more the 40% of the variation in either species or densities is accounted for by the vegetation structure.

3. SPECIES DISTRIBUTION OVER SITES

Each species has a characteristic distribution over GTNP habitats. The turnover in species from site to site measures a second component of diversity, β -diversity (in contrast to species richness within sites, α -diversity). Patterns of β -diversity show which sites are relatively homogeneous in the bird species they support, and between which sites the species composition changes more radically. A summary of these patterns is provided in Fig. 15. Five site clusters are defined by the

Figure 13. Number of Species at Monitoring Sites: 1995-1997

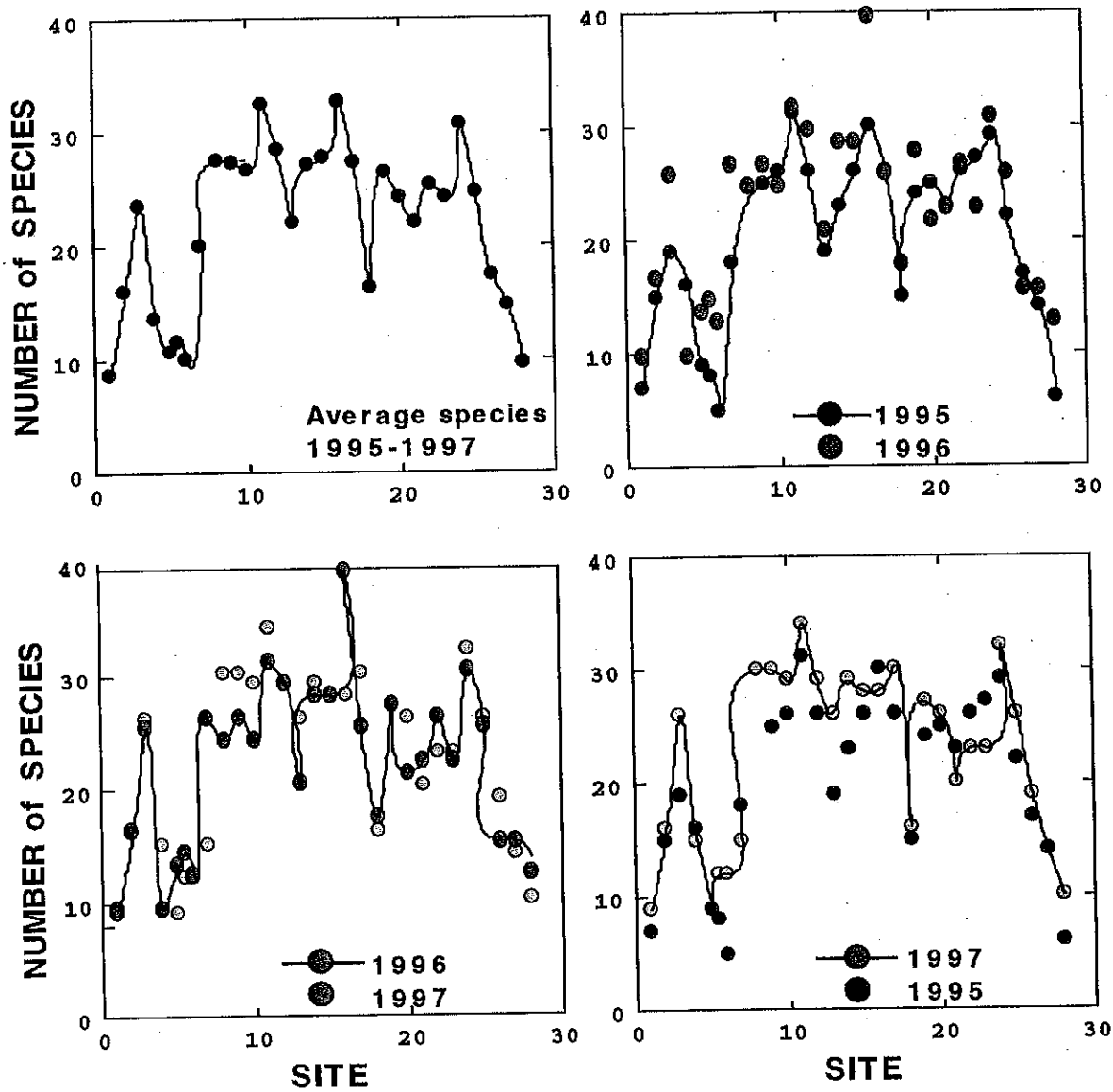


Figure 14. Bird densities at Monitoring Sites 1995-1997

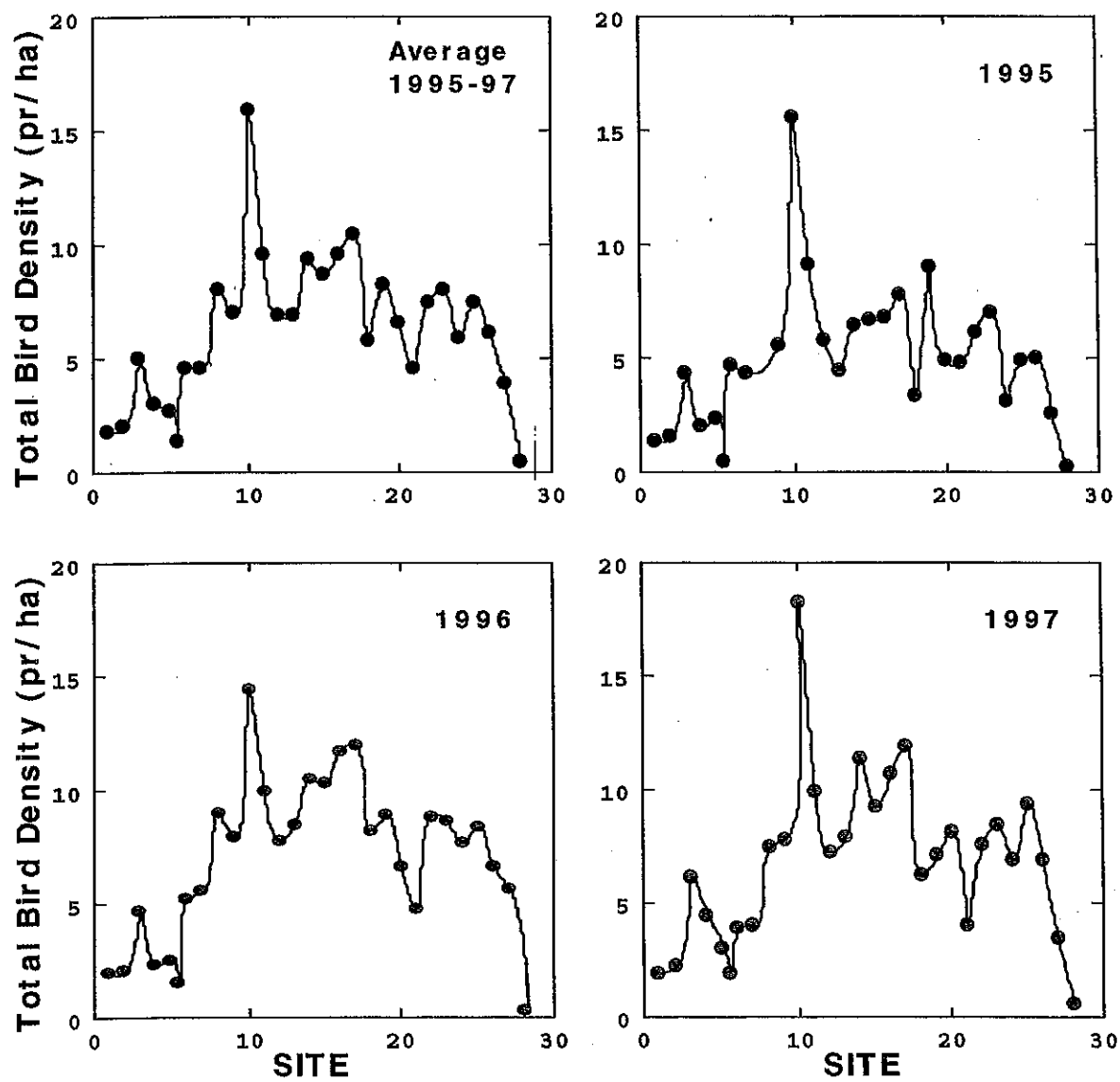
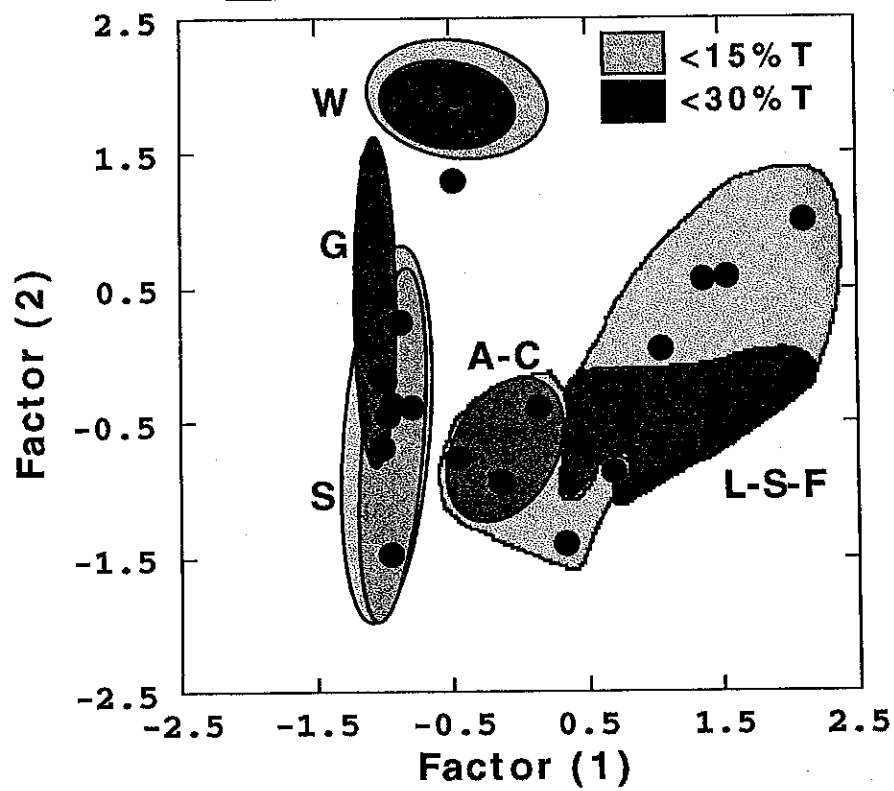


Figure 15: β -Diversity
Species Turnover among Habitats



criterion that species turnover among sites is $<15\%$. These are grassland, sagebrush, willows, aspen, and lodgepole pine. When the criterion is relaxed to accommodate 30% turnover among sites, the two cottonwood sites join the aspen cluster, and the remaining conifer forests, chiefly spruce and fir, join the lodgepole cluster.

Individual species are distributed over sites in specific ways. Some species are generalized in site use, and breed over a variety of habitats, whereas other species are very site specific, and breed in very few or even in a single site. Examples of species distributions over sites are shown in Fig. 16. Species such as American robin, White-crowned sparrow, Chipping sparrow and Dark-eyed junco breed in many monitoring sites, although each species reaches its highest density in different habitats. Distributions of three common warblers are shown in Fig. 17, as 75% confidence ellipses around sites in which they breed.

4. SPECIES DISTRIBUTION OVER TIME

Some variation over time, i.e. between years, in census results is anticipated, but such variation itself varies among sites and among species. That is, some sites produce similar results over the years, whereas others vary considerably; and some species appear relatively constant over the years, whereas others fluctuate widely in occurrence and density. Aspen bird communities (site #s 12-14) appear to have been relatively constant for many years, since Flack's 1968 censuses. Cumulative density over ranked species illustrates this constancy, as shown in Fig. 18. In contrast, lower and more open habitats appear to be more variable in species composition over the years. Results from site #7 (Two Ocean Lake Meadow) are shown in Fig. 19, where 1997 data are in strong contrast to

Figure 16. Distribution over Sites of Some Common GTNP Birds

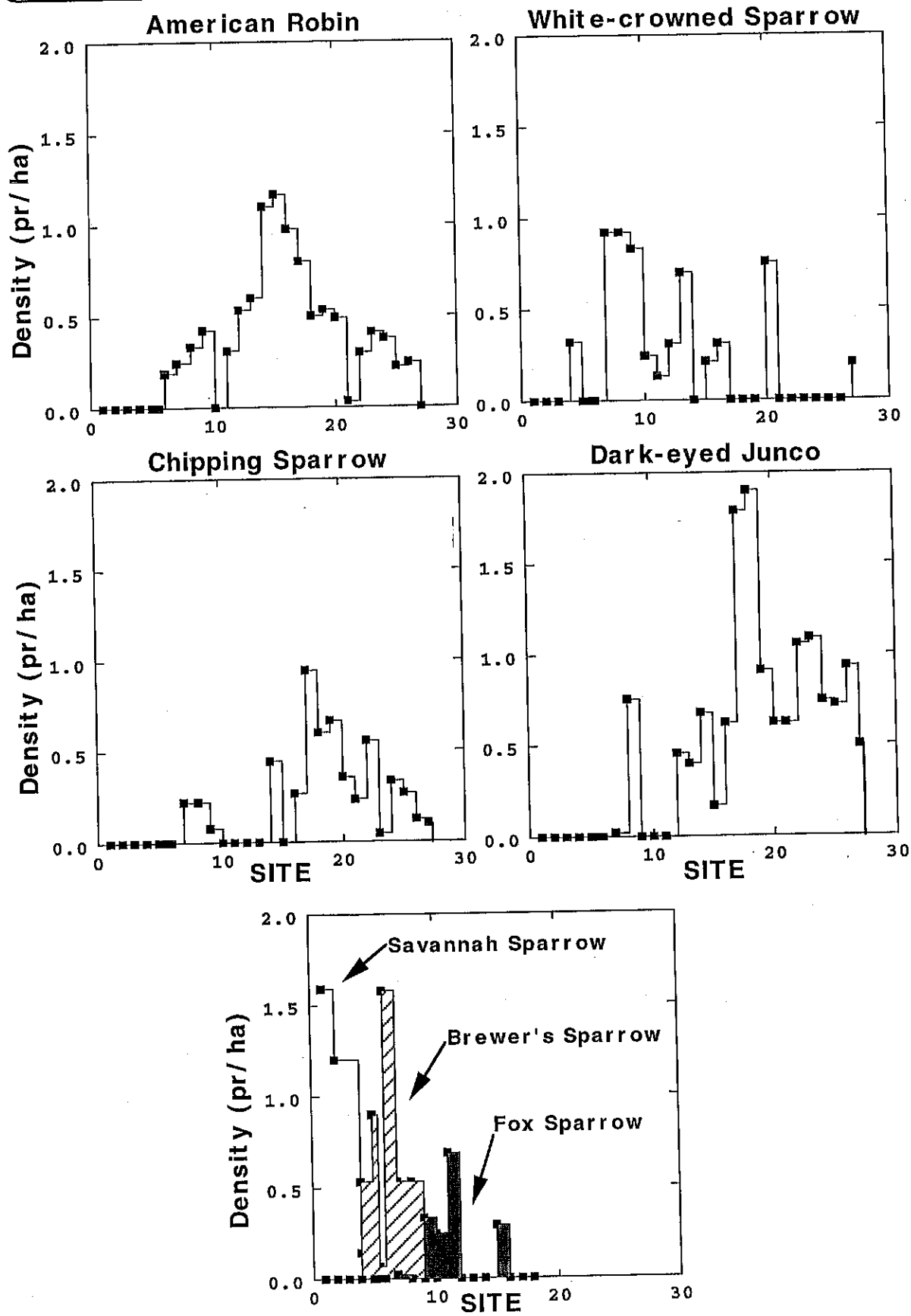


Figure 17. Distributions of Three Common Warbler Species

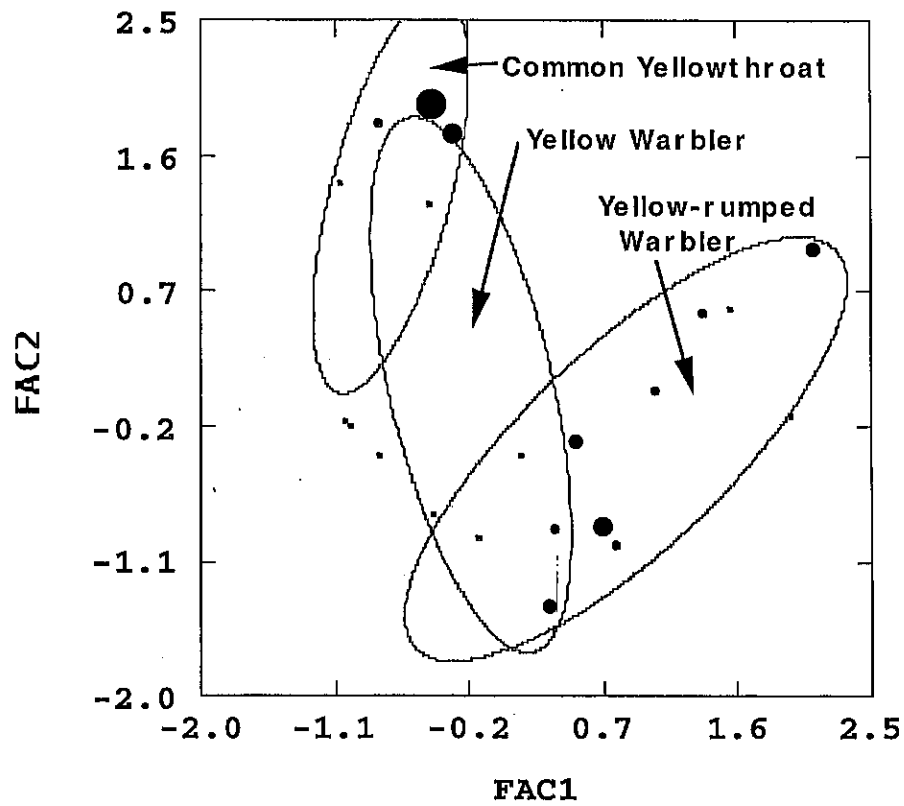


Figure 18: Comparison of breeding bird species in aspen sites, 1966-1990's

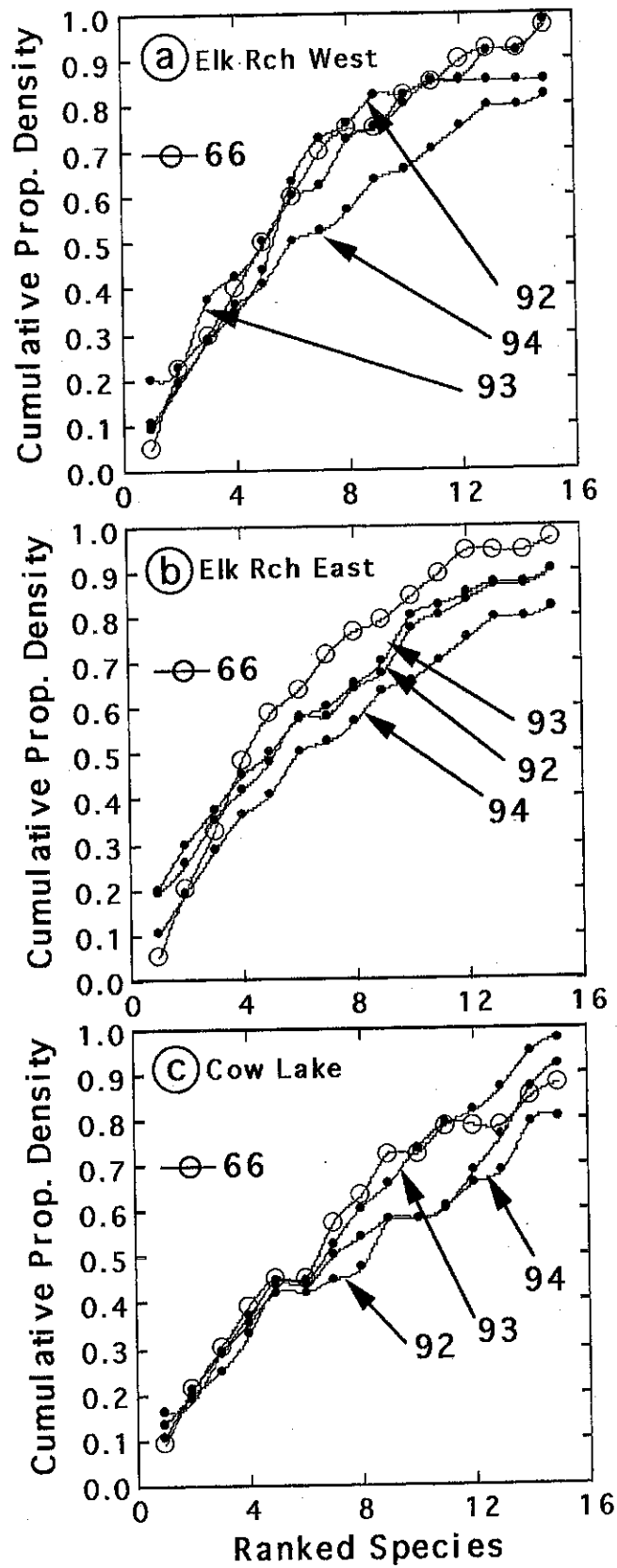
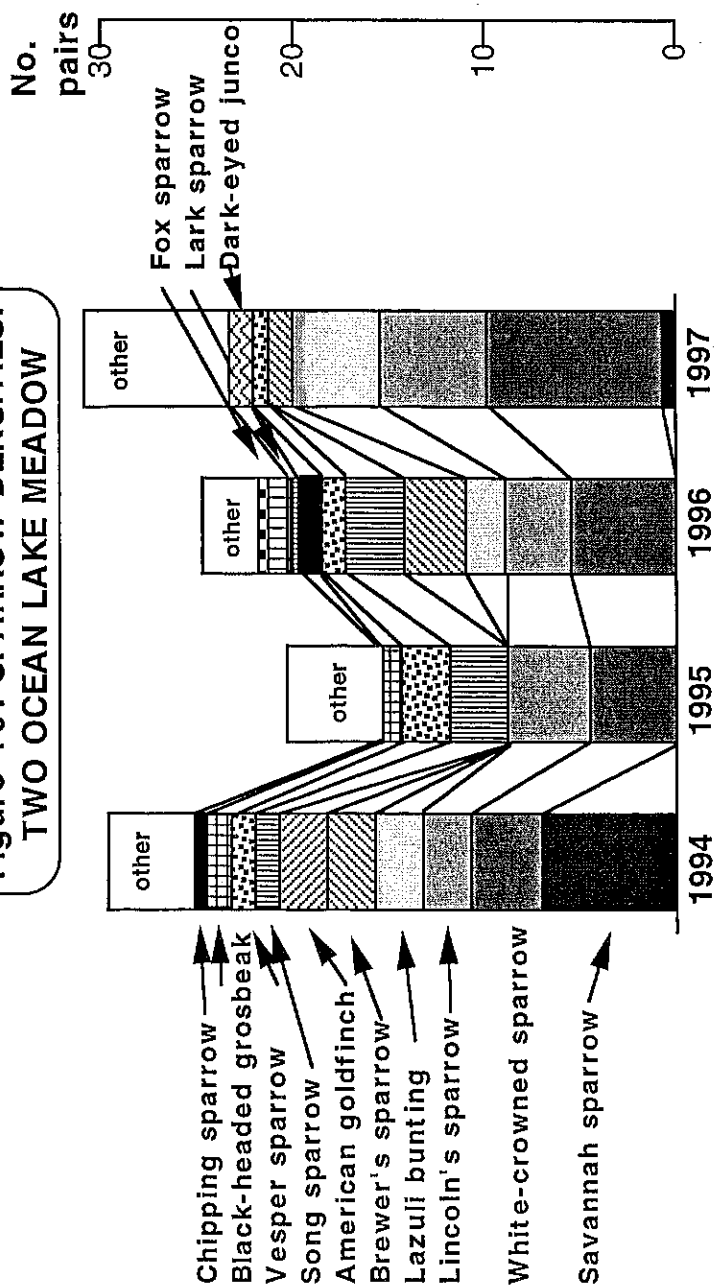


Figure 19: SPARROW DENSITIES:
TWO OCEAN LAKE MEADOW



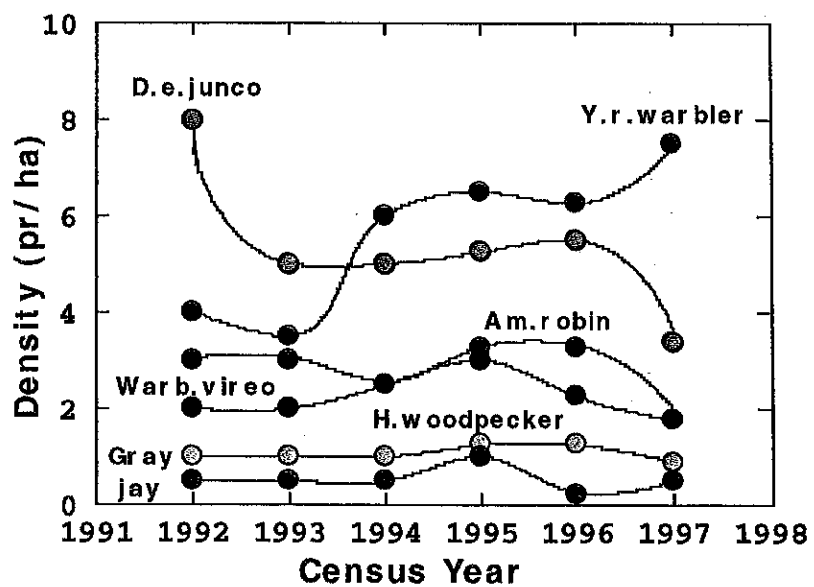
1994 data. The suite of species Savannah/Brewer's/Vesper sparrow dominated the earlier count, whereas White-crowned/Lincoln's sparrow and Lazuli bunting the later count. The former species are typical of drier grass-sage fields, the latter of brushier, wetter sites, but the transition has occurred without noticeable change in the vegetation at the site.

Site #19 (AMK lodgepole forest) has been censused since 1992. Over that period, species counts have varied 21-28, and total density 7.1-9.1 pr/ha. Fig. 20 shows that two common species have varied in density by a factor of about two, with Dark-eyed junco decreasing and Yellow-rumped warbler increasing in approximately mirror-image fashion. Four other regular species do not show any significant changes over the 6 year period. With a longer term data set, the possible causes of these changes could be investigated.

5. INTERACTION OF SPECIES X SITES X YEARS

In different years, the densities of different species respond in different ways at different sites. To illustrate these differences, consider years 1996 and 1997. In over bird densities across sites in GTNP, bird densities were very similar. However, American robin densities were overall significantly lower in 1997 than 1996, and the reverse was true for White-crowned sparrow. Robin densities were lower in virtually all sites in 1997 except for the willows sites, and White-crowned sparrow densities were lower over virtually all sites in 1996 except for the willows sites. It seems that a) the two species responded in different ways to the changes between years (whether on- or off-site effects), but b) the wet habitats buffered the densities of each species, and in these habitats the two

**Fig. 20 Density changes at AMK
Lodgepole Site over Six Census Years**



species were relatively constant between years. More and quantitative versions of such analyses will be possible with a longer term data set.

6. WILLOWS OUTGROUP SITES: #10 GTNP, GNP AND RMNP

Site #10, GTNP Wet Willows, is duplicated in both GNP and RMNP, with a view to gaining some regional perspective of population changes among years in this habitat. It was selected because of its simple floristics and easy replicability in different regions. The scheme for this comparison is shown in Fig. 21. Vegetation profiles of the three sites provide reasonable matches; vegetation height is the same in all three sites, and the differences in distribution of foliage over height are judged minor (Fig. 22).

About one-half to one-third of the species at the willow sites are termed "core species," which contribute 75% or more to total bird density and fall into five guilds (Table 4). There is some turnover of species among sites in the major species representing these guilds; GTNP willows has as its commonest species Yellow warbler, Yellowthroat, White-crowned and Fox sparrows, Willow flycatcher and Calliope hummingbird. In contrast, at Onahu Ck, RMNP, the major species are Wilson's warbler, Lincoln's sparrow, American robin, Dusky flycatcher and Broad-tailed hummingbird; at Coonsa Ck, GNP, they are Yellow warbler and Northern waterthrush, Song sparrow and Veery, Willow flycatcher and Rufous hummingbird (see Table 4). Thus there are regional shifts in the commonest guild representatives, although about one-half the species and three-quarters the total density at each site is comprised of core species. Note that the species totals are highest in the north (contrary to the usual latitudinal trends), and the highest densities are reached in GTNP.

Figure 21: WILLOWS HABITATS.
A REGIONAL COMPARISON

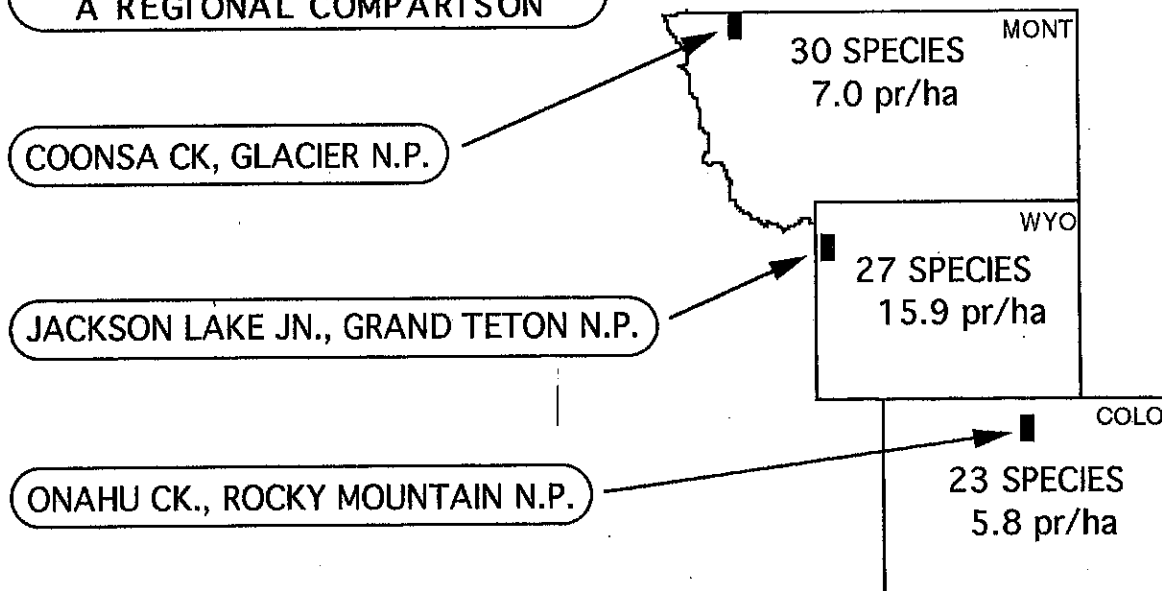


Figure 22. Foliage Profiles in Willows Sites in GTNP, RMNP, and GNP

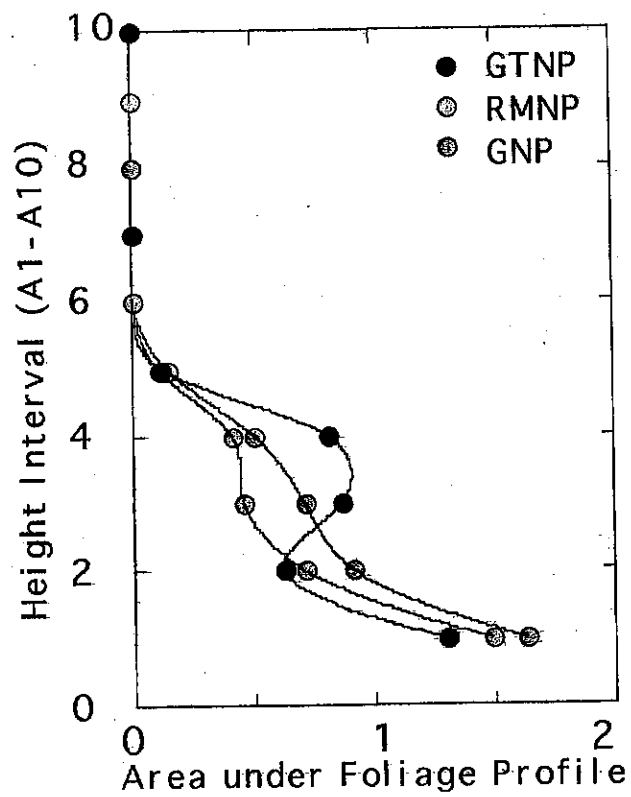


Table 4. Comparison of breeding birds in three wet willows sites: Grand Teton National Park, Rocky Mountain NP, and Glacier NP. Core species are listed, those not water-dependent and with territories at least potentially entirely within census plots. GTNP data are 7y averages, in pr/ha, 1991-1997; RMNP data 1995-97; GNP data are 1996-97. *indicates occasional breeder; ** regular forager.

Species	GNP 10ha	GTNP 3.5ha	RMNP 6.5ha
FOLIAGE INSECTIVORES: "PARULID" GUILD			
American redstart	0.05	0	0
Orange-crowned warbler	0.05	0	0
Warbling vireo	0.03	0.004	0
Northern waterthrush	0.58	0.06	0
MacGillivray's warbler	0.19	0.10	0
Yellow warbler	1.78	2.65	0.05
Common yellowthroat	0.68	2.35	0.12
Wilson's warbler	0	0.86	1.41
Marsh wren	0	0.17	0.04
SMALL LOW/GROUND FORAGERS: "EMBERIZID" GUILD:			
American goldfinch	0.04	*	0
Savannah sparrow	0.08	0.07	0.21
Song sparrow	0.54	1.62	0.12
Lincoln's sparrow	0.17	1.02	1.83
White-crowned sparrow	0.13	0.85	0.22
Fox sparrow	0.28	0.99	0.12
Black-headed grosbeak	0.04	*	0
LARGE GROUND FORAGERS: "TURDID" GUILD			
Veery	0.24	0	0
Gray catbird	0.10	*	0
American robin	0.11	0.10	0.17
Swainson's thrush	0	0.005	0.01
AERIAL FLYCATCHERS			
Willow flycatcher	0.33	0.58	0.14
Dusky flycatcher	0	0	0.28
Mountain bluebird	0	0	0.03
NECTARIVORES			
Rufous hummingbird	0.05	0	0
Calliope hummingbird	0	0.22	0
Broad-tailed hummingbird	0	*	0.32

CORE SPECIES:	20	16	11
CORE DENSITY:	5.5	11.6	5.1
TOTAL SPECIES CUM):	38	40	33
TOTAL DENSITY:	7.0	15.7	5.8

Of interest is whether population shifts occur at the willows sites in parallel between years or otherwise. GNP and GTNP share 12 core species (Fig. 23); population changes in density 1996-1997 (scored as +, -, or 0, the latter if populations were within 10% of each other between years) were the same in 9/12 core species, a result that should not occur by chance (Chi-squared analysis, $p < .01$). GNP and RMNP share fewer core species (9), and similar density shifts are observed in no more species (5) than expected by chance ($p > .05$). GTNP and RMNP censuses are available for 1995-1997, and shared trends can be evaluated in two successive adjacent years, 1995-96 and 1996-97. In neither case is there evidence for parallel changes in density. Interestingly, GTNP and RMNP do share a common feature, in that trends in both sites 1995-96 were significantly reversed 1996-97, in parallel. A more extensive data set would enable site-specific, inter-site (regional), and extrinsic factors to be separated, but this is not possible with data covering only several years.

7. DETAILED COMMUNITY ANALYSES: SITES #4, #10.

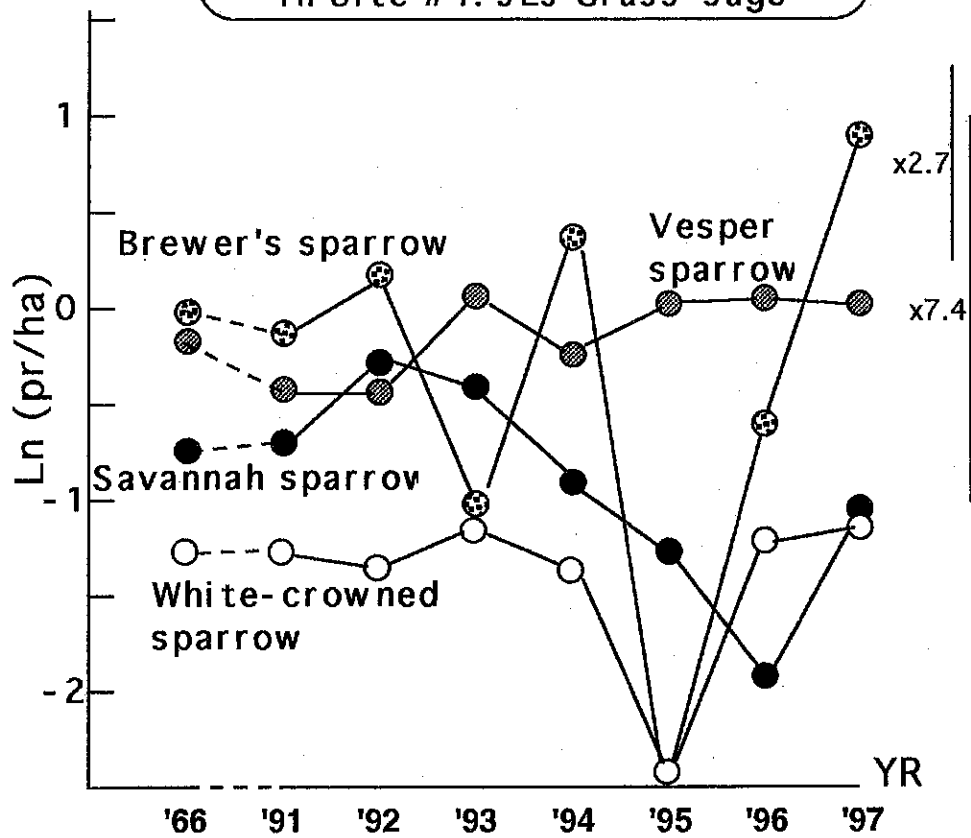
Detailed studies on community structure have been conducted on GTNP monitoring sites #4, 10 for some years (Cody 1974, 1991, 1992, 1994, 1996, 1997). Relevant here are details of population trends over the period of study; other details of community structure and analysis, many published, are omitted.

Site #4, JLJ Grass-sage, is populated mainly by emberizine sparrows. The numbers of the four common species during census years are shown in Fig. 24. One species (Vesper sparrow) has remained at about constant density over a 30-yr period. Savannah sparrow declined over 5 yr but recovered somewhat in 1997. Two species, Brewer's sparrow and White-

Figure 23. Population Trends Shared among Core Species of Willows Sites among Years

	Shared Core Species	Number of species with shared trends (increase, decrease, or remain same to $\pm 10\%$):
GNP-GTNP 1996-97	12	Obs: 9; Exp: 4, $p < .01$
GNP-RMNP 1996-97	9	Obs: 5; Exp: 3, $p > .05$
GTNP-RMNP 1996-97	12	Obs: 4; Exp: 4, $p > .05$
GTNP-RMNP 1995-96	12	Obs: 5; Exp: 4, $p > .05$

Figure 24: Densities of Sparrows
in Site #4: JLJ Grass-sage



crowned sparrow, declined precipitously and in synchrony in 1995, but both recovered to at least pre-1995 levels in the following two years. A site specific feature might account for the decline, the extremely late snow-melt at the northern end of Jackson Hole in 1995, but why the other two species were not similarly affected is yet not explained.

In the Wet Willows site (#10) census data are available for a similarly long time period. Figure 25 shows density data for emberizines, and Fig. 26 for parulines. Several features of the sparrow data are noted:

- a) The four commonest species (Song, Fox, Lincoln's and White-crowned sparrows) have maintained relative steady densities over the 30 yr period;
- b) To a significant degree, the densities of Song and Lincoln's sparrow are inversely correlated, with Song sparrow more prevalent in wet years and Lincoln's in dry years;
- c) Savannah sparrow is of sporadic occurrence and at very low density;
- d) Clay-colored sparrow was common in the 1966 census, but has not bred at the site in the 1990's, and to my knowledge has occurred very sporadically within GTNP in these later years.

The paruline warbler densities appear somewhat more variable, although a) those of the two commonest species, Yellow warbler and Common yellowthroat, have remained quite constant. b) Wilson's warbler declined dramatically in 1992, has since recovered somewhat, but is still not up to 1996-1992 density levels. c) Two other parulines, Northern waterthrush and MacGillivray's warbler, are sporadic at the site, at best present in low density. 1992 was a wet year at the site, and this correlates to Northern waterthrush incidence, as the species breeds here only in wet years. The 1992 year was that in which Wilson's warbler showed the greatest drop in density. In 1993, a drier year, Northern waterthrush was absent, and both Wilson's and MacGillivray's warblers increased. These

Note: 1992 was the last year
92- very dry spring
1993- very wet spring

Figure 25. Densities of Sparrows
in Site #10, JLJ Wet Willows

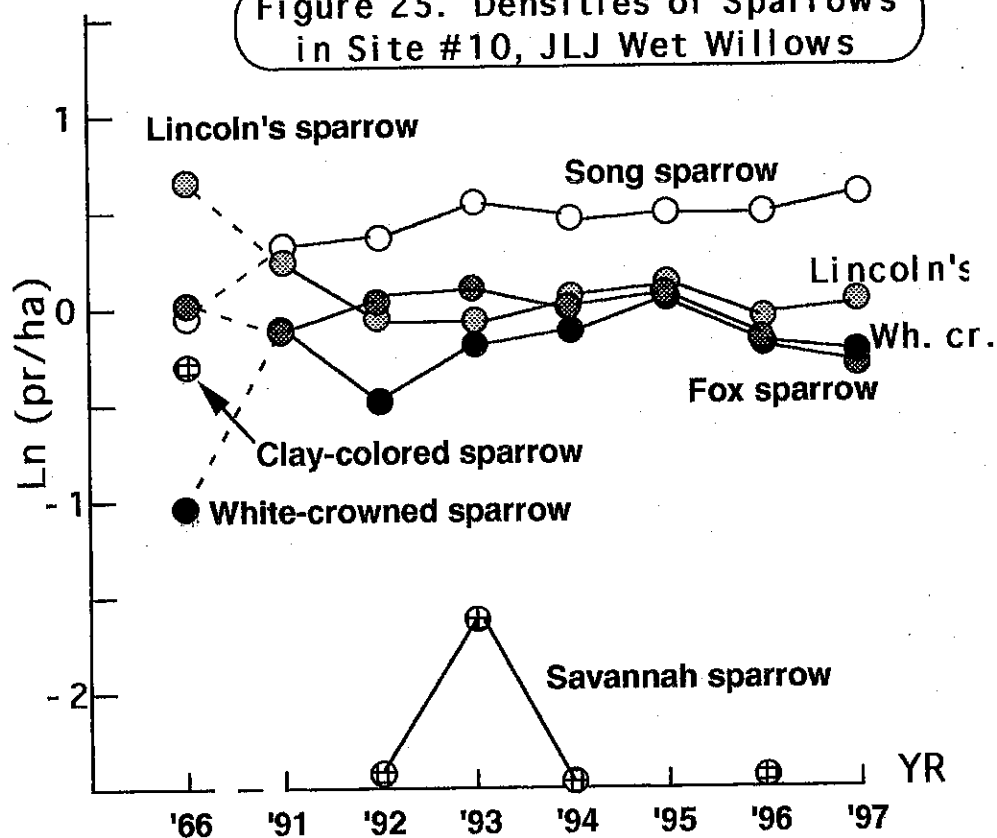
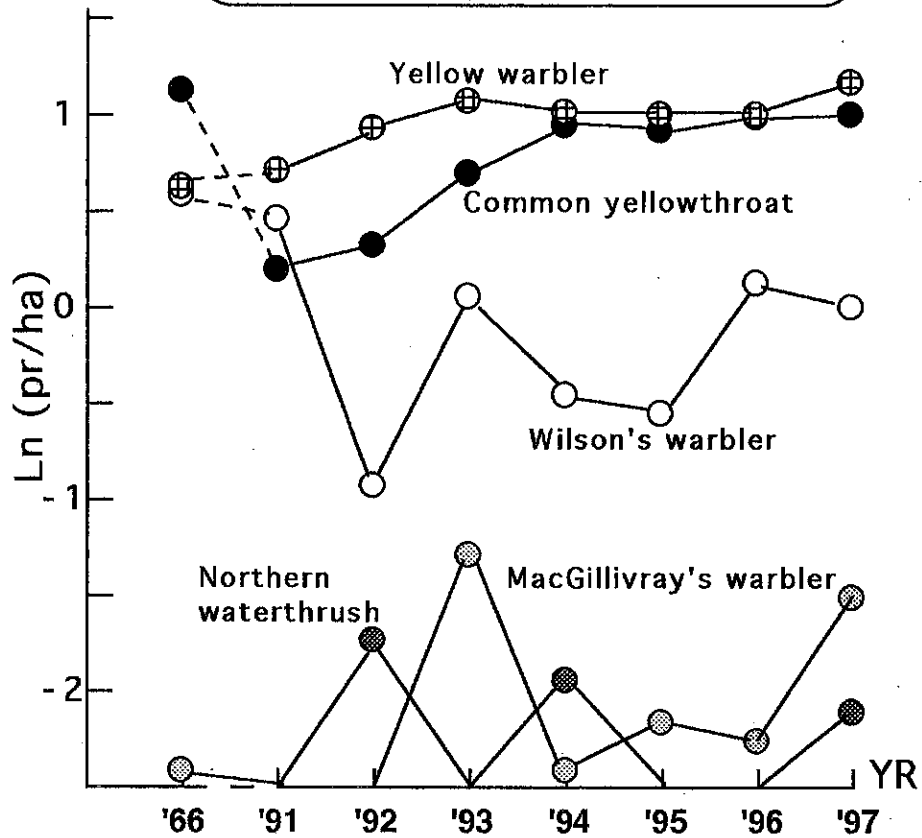


Figure 26: Densities of Warblers
in Site #10, JLJ Wet Willows



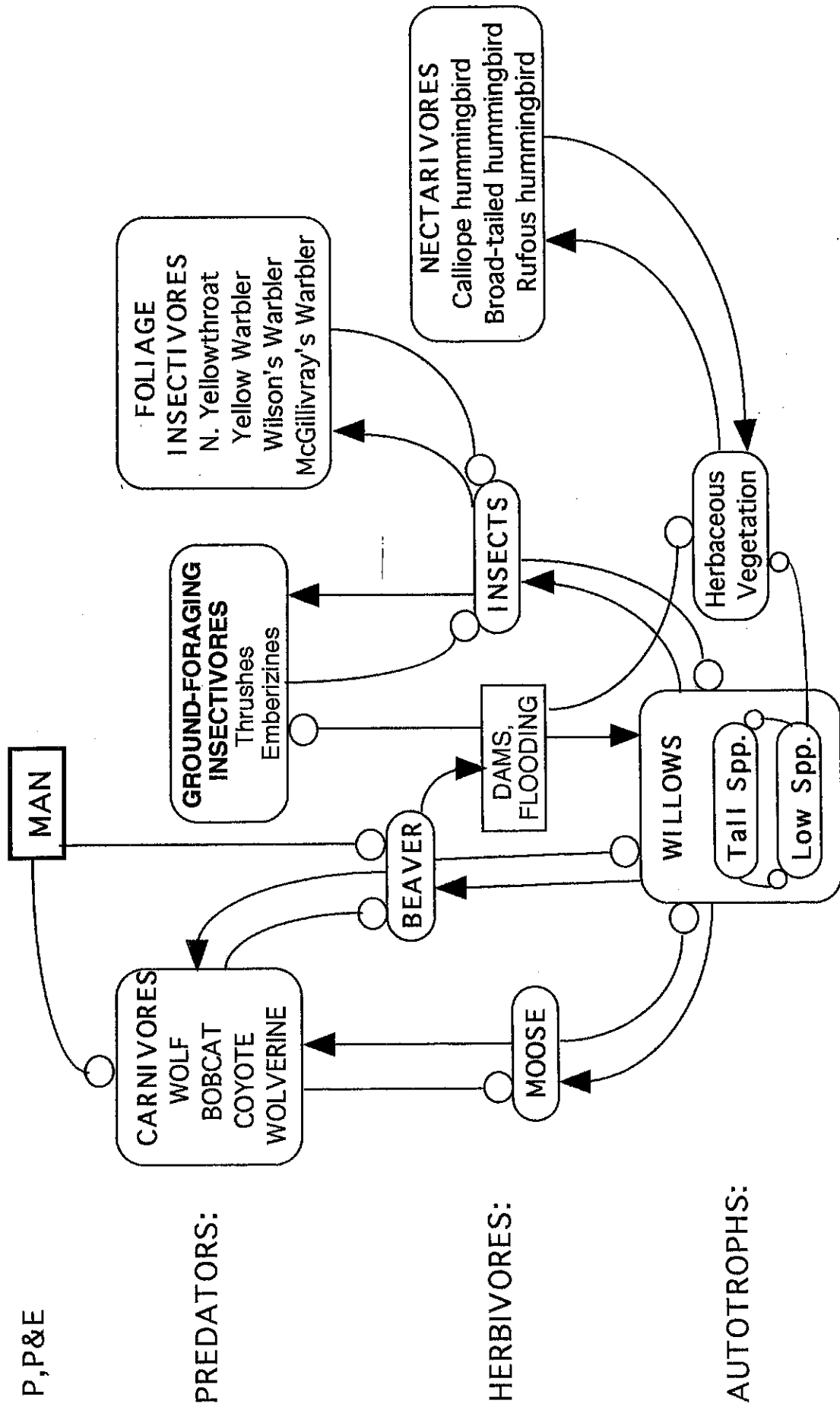
latter two species tend to vary in synchrony (Fig. 26); generally increasing in drier years and in opposition to the waterthrush numbers. A more detailed analysis of these trends, and the segregation of on-site from off-site factors, will be possible when a longer data set is accumulated.

8. EXCLOSURES: DRY WILLOWS SITE #9.

Willows habitats are becoming well-known as breeding bird densities are measured in successively years, both at GTNP and elsewhere. Concomitantly, measures of insect availability have been made in each year in the willows sites (#9, 10) in GTNP, using Tanglefoot boards; notably, virtually all breeding birds in these habitats are insectivorous. But the birds and insects are only part of a larger willows ecosystem which has other conspicuous members, such as the large browsing ungulates that pre-empt much willow productivity and the beavers that not only feed on willow but alter drainage channels, and thus directly affect vegetation structure (to which the birds may respond).

A diagrammatic view of the willows ecosystem is given in Fig. 27. There are around a dozen willow species, and competition between taller and shorter species must occur (as represented by links ending in a circle). Willows can also suppress herbaceous vegetation, which persists only in openings in the taller vegetation. Birds are affected by both shifts in vegetation structure (e.g. more or fewer openings, taller vs. shorter willow vegetatio) and by insect densities, mostly herbivorous insects largely dependent on the willows. Beavers, and ungulates such as moose, eat willows and compete indirectly with insects for the food base, and beavers can affect the topography and drainage at the site by dam activity. Carnivores can potentially regulate moose and beaver populations, but

Figure 27: An Extended Diagram of the Wet Willows Ecosystem



their densities, as well as those of the beaver in historical times, have been to a large extent regulated by man's intervention (the P,P&E level in the diagram represents "Philosophy, Politics and Economics").

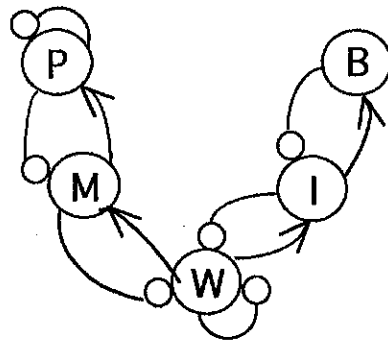
As per our 1996 proposal to GTNP management, two exclosures, 16' x 24' and 8'19' high, were erected at Site #9 (RKO Dry Willows). Construction was completed in Sept 1996; both exclosures are impermeable to elk, bison, moose and deer (all of which occur at the site), and one is additionally wrapped with aviary wire that excludes birds. A control site of similar size is located between the two exclosures.

A simplified version of the willows ecosystem loop diagram is given in Fig. 28: moose and insects both feed on willows, and in turn support their predators, which are birds in the case of insects, and largely absent carnivores in the case of moose. Erecting exclosures allows willow herbivory only in insects, to which birds may respond in one exclosure but not in the other to which their access is denied. Excluding large browsers (moose et al.) is akin to elevating predation levels on the ungulates and reducing their densities, which might in fact occur if e.g. wolves were re-introduced to GTNP. By loop analysis, this system is asymptotically stable.

Responses to the exclosures are measured in three ways: a) insect Tanglefoot traps are set within exclosures and controls; b) shoot elongation and leaf area per shoot diameter are measured within exclosures and in the control; c) bird foraging activity is measured in the control and in the one exclosure to which birds have access. Expectations are, in exclosure A from which large browsers but not birds are excluded, that i. willow W will increase, birds B will also increase, but not detectable change in insects I will occur. In exclosure B, from which birds additionally are excluded, i. willows W should remain constant, kept so by ii. higher insect densities

Figure 28: Loop Analysis of a Simplified Willows Ecosystem

P = Predator
M = Moose
W = Willows
I = Insects
B = Birds



System matrix

	W	M	P	I	B
W	-	-	0	-	0
M	+	0	-	0	0
P	0	+	-	0	0
I	+	0	0	0	-
B	0	0	0	+	0

Feedback F_k :

All F_1 through $F_5 < 0$;

and $F_1 F_2 + F_3 > 0$;

System is asymptotically stable.

Evolution/increase* in predator P produces:

- decreased M;
- increased W
- no change in I
- increased B

that are unregulated by the excluded birds. The first measurements were made in late July 1997, but so far little change of consequence has occurred. It is projected that conspicuous change should be detectable within a 5-yr period, after which a decision on whether the experiment should be continued will be evaluated.

Will
Follow-up

H. FUTURE PROJECTIONS OF THE MONITORING PROGRAM

The value of a breeding bird monitoring program may be obvious, but can be restated as follows. Small birds are conspicuous, diurnal, and are easily and accurately censused on their breeding habitats; they are the chief insectivores in these habitats; their densities respond within GTNP to habitat differences among sites, and to within-habitat changes among years; their migration strategies are diverse, and range between the extremes in-habitat residents to long-distance migrants; thus the potential impact of off-site influences can be assessed in principle. Overall, small birds are most useful bioassays of habitat health and quality, and ideal subjects for long-term monitoring studies.

While the potential advantages accruing from long-term monitoring of breeding bird populations, for assessment, management, conservation as well as purely academic (scientific, ecological) reasons are clear, they are demonstrable only with a long term data base. This is at present lacking, and this report shows at best the potential value of a long term monitoring program; it cannot demonstrate its actual worth, which will be apparent only as the time period of data collection is extended. Over the last three years, the basic requirements of the monitoring program have been established. If it is extended into the future, its assets should become apparent and more so with its greater duration.

It is relevant that no comparable monitoring program exists, to my knowledge, in other National Parks in the Rocky Mountains. Indeed, it was difficult to find NPS personnel at other parks that had any knowledge, other than the most rudimentary, of bird species, populations, locations and distributions, breeding habitats etc. The permanent establishment of a monitoring program at GTNP would be a unique model, and one to which other parks might look not only for information but perhaps for emulation.

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APPENDIX C.

SUMMARY CENSUS DATA OF GTNP (GNP, RCMP) BREEDING BIRD MONITORING SITES

Census results are reported in this appendix from 30 GTNP monitoring sites, plus the two willows outgroup sites at GNP and RMNP. Most summaries include numbers of breeding birds (pairs) in the body of the tables, and a) total species, b) total bird numbers at the site, and c) total breeding bird densities (pr/ha) are included at the bottom of the tables. One exception is site #10, which has breeding birds in pr/ha within the body of the table. Densities of large species (raptors, corvids > jays, anatids, some shorebirds, cranes, etc) are estimates only; such species' records should be regarded as more of presense/absense data. Most sites report census results from three successive years 1995-1997, but some sites have been covered for several preceeding years, and a couple of sites go back even further. Latin names for species are given in Appendix A; common names used here should be fairly unambiguous.

Site.1.Summary

Species/Year	1992	1993	1994	1995	1996	1997
Sandhill crane	Yes	Yes	0.1		0.1	0.05
Savannah sparrow	Yes	Yes	8	8.5	11.93	10
Raven				0.025	0.1	0.1
Swainson's hawk					0.025	
Snipe						0.625
W.Meadowlark	Yes	Yes	0.5	0.613	1.25	0.5
American crow			0.1		0.05	0.05
Starling				0.75	1	3.25
Bl.billed magpie				0.1	0.15	
Brewer's blackbird				0.25		
Tree swallow				0.25		
American kestrel						0.05
Red-tailed hawk						0.025
Long-b.curlew					0.1	
Lincoln's sparrow					0.25	
TOT.SPP.:	0	0	4	7	10	9
TOT.DENS.:	0	0	8.7	10.49	14.96	14.65
PR/HA:	0	0	1.16	1.398	1.994	1.953

SITE.2.Summary

SITE 2; JACKSON LAKE JUNCTION GRASS-SEDGE					
SPECIES/Year	1993	1994	1995	1996	1997
Barn swallow			0.5	0.5	0.625
Marsh hawk					..05
Cliff swallow	4	4	2.25	1	1.125
N roughwing swallow					0.125
Brewer blackbird			0.05	0.25	
Sandhill crane	0.1	0.05	0.075	0.2	0.1
Savannah sparrow	10	9	10	12	13.75
Raven		0.1		0.05	0.05
Swainson's hawk		0.05	0.025		
Snipe			1.5	1.5	1.25
American crow	0.1			0.1	0.1
Yellowthroat		0.5	1	1.5	2
Calliope humminb		0.25			
Tree swallow			0.5	0.25	
American robin			0.05	0.05	
Mallard			0.5	0.5	0.5
Gadwall			0.25	0.25	
Canada goose			0.05	0.5	
Song sparrow			0.5	1	0.75
Common starling			0.125		
Yellow warbler				1	1.5
Black-b.magpie				0.125	0.125
White-cr.sparrow					0.5
Lincoln's sparrow					0.25
Sharp-sh.hawk					0.025
TOT.SPP	4	7	15	17	16
TOT.DENS.:	14.2	13.95	17.38	20.78	22.78
PR/HA	1.42	1.395	1.738	2.078	2.278

Site.3.Summary

SITE 3: ELK REFUGE WET MEADOW				
Species/Year	70694	1995	1996	1997
Gt. blue heron			0.05	
Sandhill crane		0.025	0.125	0.05
Canada goose				0.5
Mallard			0.75	2.25
Green-w. teal				0.25
Cinnamon teal				0.75
Gadwall		1	0.5	1
Widgeon			0.25	0.25
Sora			1	0.5
Long-billed curlew		0.05	0.25	
W. phalarope			0.125	0.25
Snipe	1	1		2
Franklin's gull			0.25	
Red-t. hawk			0.025	
Osprey			0.1	
Tree swallow	1.5	2	1.5	2
Violet-green swallow		0.25		
Rough-w. swallow			0.75	
Cliff swallow	1.5	0.5	1.25	1
Barn swallow	3	2.5	1	2.375
Bank swallow			0.25	
Common raven		0.025	0.05	0.1
American crow				0.1
Marsh wren		0.5	0.5	0.5
European starling		2.25	3.9	0.375
Yellowthroat	2	1.75	1	4.75
Savannah sparrow	9	15.5	17.5	21
Song sparrow			0.25	
Bobolink	2	4		1.5
W. meadowlark	1.5	0.825	1	1
Yellow-h. blackbird	6	1	1	5
Red-w. blackbird	2	3.75	2.5	3.5
Brewer's blackbird		0.5	2.5	0.25
American goldfinch		0.25		
Cedar waxwing				0.25
Common grackle				0.05
TOT. SPP:	10	19	26	26
TOT. DENS:	29.5	37.68	38.38	51.55
PR/HA	3.512	4.485	4.568	6.137

SITE.4.SUMMARY

	SITE 4: JACKSON LAKE JUNCTION GRASS-SAGE							
Species	1966	1991	1992	1993	1994	1995	1996	1997
Savannah sparrow	2.2	2.5	3.5	3	1.9	1.3	0.7	1.2
Cliff swallow						0.5		
Brewer blackbird						0.75	1	1.5
Raven						0.05		0.1
Wh.cr.sparrow	1.29	1.3	1.2	1.5	1.2	0.35	1.5	0.8
Am. robin						0.1		0.375
Chipping sparrow						0.7		
Red-tailed hawk								0.05
Swainson's hawk								
Vesper Sparrow	3.88	3.1	2.9	5	3.6	4.55	4.8	6
Brewer's sparrow	4.57	4.1	5.4	1.67	6.5	0	2.5	9.5
Br.headed cowbird						0.1	0.25	0.5
Red-sh.flicker						0.1	0.1	
Rough-w. swallow								0.125
Violet-gr.swallow							0.1	
Sandhill crane						0.05		0.05
Tree swallow						0.5		0.5
Barn swallow						0.5		0.125
Common starling						0.1		
Bl.billed magpie						0.1		0.1
Kildeer								0.1
TOT.SPP.:	4	4	4	4	4	16	8	15
TOT.DENS.:	11.94	11	13	11.17	13.2	9.75	10.95	21.03
PR/HA:	2.551	2.35	2.778	2.387	2.821	2.083	2.34	4.493

Site.5.Summary

SITE 5: ANTELOPE FLATS BURNED AND UNBURNED SAGE						
Species/Tear	1995	1995	1996	1996	1997	1997
Status:	Bn	Not	Bn	Not	Burn	Not
Cliff swallow	0.15	0.75	1	1.5	0.5	0.5
N Roughwing swallow					0.15	
Brewer blackbird		0.5	0.5	0.5	0.9	0.9
Raven	0.01	0.03	0.1	0.05	0.1	0.1
Marsh hawk		0.03	0.1		0.05	0.05
Vesper Sparrow	2.2	4.75	4.5	3.25	6.25	6.5
Brewer's sparrow		6.5	0.5	6.75		8.75
Br.headed cowbird					0.25	
Northern flicker		0.75		0.5		
W.Meadowlark	1.05	1.8	1	1.5	1.25	1.15
Sage grouse	0.3		0.5	0.5		
Green-t.towhee		3.75		2		2
Mourning dove	0.2					
Prairie falcon	0.01					
Common starling	0.1		2.5	1.75	5	2.75
Savannah sp			0.125			
Sandhill crane			0.05		0.05	
Long-b.curlew			0.375		0.15	
Am. kestrel			0.1	0.05	0.1	
Tree swallow			0.5	0.25		
Swainson's hawk			0.05	0.05		
Red-t. hawk				0.05		
TOT.SPP.	8	9	15	14	12	9
TOT.DENS.	4.02	18.9	11.9	18.7	14.75	22.7
PR/HA	0.54	2.51	1.587	2.493	1.967	3.027

Site.6.Summary

SITE 6: AIRPORT SAGEBRUSH					
Species/Year	1993	1994	1995	1996	1997
Cliff swallow			1.5	0.5	0.125
Brewer blackbird	0.5			0.625	0.75
Raven	0.1	0.1		0.05	0.1
Marsh hawk		0.05		0.05	
Swainson's hawk				0.05	
Vesper Sparrow	4	4	5	4.5	2.5
Brewer's sparrow	8	9	7.5	9.5	9.75
Br.headed cowbird					
Red-sh.flicker					
W.Meadowlark	0.5	0.5	2	1.75	0.5
Sage thrasher	1	0.5		1.5	1.25
Sage grouse	2			0.375	0.25
Green-t.towhee	8	8	12.5	9.75	8
Mourning dove		2		0.75	
Rough-w. swallow		0.5			
American robin				1.125	
American kestrel					0.025
Common nighthawk					0.25
Tree swallow					0.125
TOT.SPP.:	8	9	5	13	12
TOT.DENS.:	24.1	24.65	28.5	30.53	23.63
PR/HA	4.82	4.93	4.75	5.088	3.938

Site.7.Summary

SITE 7: TWO OCEAN LAKE MEADOW					
Species/Year	1993	1994	1995	1996	1997
Sandhill crane	0.05	0.1		0.05	
Savannah sparrow	6	5			0.5
Raven		0.1	0.1		0.1
Mourning dove		1			
Brewer's sparrow		2		2.5	0.5
Vesper sparrow		1	2	1	0.5
Red.t. hawk		0.1		0.025	
Swainson's hawk	0.1		0.1	0.1	0.025
Am. goldfinch		2			
White-cr. sparrow	3	3	3.5	4.25	5.75
Rufous hummingbird		1	2		
Lazuli bunting		2		1.75	3
Song sparrow		1	2.5	2.25	
Chipping sparrow		0.5		1	
Robin	0.2	1.5	0.5	1.125	0.75
Northern flicker	0.2		0.1	0.5	
Red-npd. sapsucker		0.5	0.25	0.25	
Bl. h. grosbeak		1	0.25		
Mt. bluebird		0.5		1	0.25
Tree swallow	2	3	4	2	2.5
Willow flycatcher	1		0.5		
Dusky flycatcher		0.5		0.75	0.5
House finch	1				
Lincoln's sparrow	2	2	3.5	2.75	2.125
Brewer's blackbird			0.35		0.25
Violet-green swallow			0.25		
Brown-h. cowbird			0.35	0.75	0.75
W. wood pewee			0.1		
Clark's nutcracker			0.05		
Warbling vireo				0.125	
N. harrier				0.05	
Fox sparrow				0.125	
Wilson's warbler				0.5	
Lark sparrow				0.5	
D.eyed junco				0.125	0.75
Orange-cr. warbler				0.25	
Cedar waxwing				0.5	
Euro. starling				0.1	
Br.t. hummingbd				0.5	
TOT.SPP.:	10	20	18	27	15
TOT.DENS.:	15.55	27.8	20.4	24.83	18.25
PR/HA	3.38	6.043	4.435	5.397	3.967

Site.8.Summary

SITE 8: TRIANGLE X ASPEN SCRUB		
SPECIES/YEAR	1996	1997
Raven		0.05
Brewer's sparrow	2.5	1.5
White-cr.sparrow	4.25	2.75
Rufous hummingbird	0.5	
Br.t.hummingbird	0.5	1.5
Lazuli bunting	0.5	
Chipping sparrow	1	2
Robin	1.5	1.5
Northern flicker	0.75	0.75
Tree swallow	0.5	
Dusky flycatcher	1	2.75
Cassin's finch	1	0.5
Lincoln's sparrow	4.5	4.5
Brown-h. cowbird	0.5	
W. wood pewee	0.25	0.25
Clark's nutcracker	0.5	0.375
Warbling vireo	2.75	3
D.eyed junco	3.5	2.5
Orange-cr.warbler	2.25	2
Cedar waxwing		
Green-t. towhee	5	2.25
Western tanager	0.5	0.5
Pine siskin	2	0.75
Red crossbill	1.75	0.25
Mt. chickadee	1.5	1.25
Hairy woodpecker	0.5	0.5
Cliff swallow	0.25	0.125
Bl.headed grosbeak		0.25
Red-br.nuthatch		0.25
Yellow-r.warbler		0.5
Red-t. hawk		0.05
House wren		0.25
Clay-colored sparrow		0.5
Fox sparrow		0.25
Mountain bluebird		0.5
TOT.SPP.:	25	30
TOT.DENS.:	39.75	34.1
PR/HA	8.641	7.413

Site.9.Summary

SITE 9: RKO/SNAKE RIVER BOTTOMS DRY WILLOWS					
Species/Year	1993	1994	1995	1996	1997
Sandhill crane		0.05			
Sora				0.75	2
Savannah sparrow	1				
Am. kestrel		0.1		0.1	
Raven	0.2	0.15	0.05	0.1	0.05
Am. crow				0.05	
Gray jay				0.1	
Red-t. hawk		0.1		0.05	0.05
Swainson's hawk				0.05	
Vesper sparrow		0.25			
Brewer's sparrow		1.5			
Brewer's blackbird	1	0.5	0.5	0.25	1.25
Mourning dove		1			
Snipe	1	1	1.25	2	3
White-cr.sparrow	3	2.5	2.25	5	2.25
Rough-w.swallow		1.5	0.75	0.25	
Br.head.cowbird	0.5	1.5	1	1	1.25
Robin	2.5	1.75	2.75	2.5	3.25
Red-sh.flicker	1	1	0.75	0.75	
Green-t.towhee	1	0.5	0.25		
Song sparrow	4	4	3.75	8.5	4.5
Cedar waxwing		0.5			
Mt.bluebird		0.5		0.25	0.5
Willow flycatcher	3		0.5	2.25	2.75
Dusky flycatcher	1	2.5	1.75	2.5	1.5
Lincoln's sparrow	2	3	2.75	2.75	1.25
Yellowthroat	8	4	3.25	3.25	5.5
Yellow warbler	8	7.5	7.75	10	12.5
Fox sparrow	2	2	0.5	2	2
Chipping sparrow		0.5	0.5	0.5	0.675
Magpie	0.5	0.5			
Wilson's warbler	2				
Warbling vireo	1	0.5			
Br.t.hummer		0.5			0.5
Calliope humming		0.5	0.5		
Cassin's finch	1		0.25		0.375
Pine siskin		0.5			0.25
Blck-c.chickadee			0.5	0.5	
Black-h. grosbeak			0.5		0.25
Red-naped sapsuckr			0.5		0.5
Dark-eyed junco			0.13		
Tree swallow			0.75	0.625	0.125

Site.9.Summary

Orange-cr. warbler			0.5		
Kildeer				0.25	0.75
Mallard				0.25	0.25
G.blue heron				0.05	0.125
House wren					0.5
Violet-gr.swallow					0.375
Bank swallow					0.25
Gray catbird					0.25
Willet					0.25
TOT. SPP.:	20	28	25	27	30
TOT.DENS.:	43.7	40.35	33.93	45.88	47.03
PR/HA:	7.283	6.725	5.655	7.646	7.838

Site.10.Summary

	SITE 10: JACKSON LAKE JUNCTION WET WILLOWS							
Species/Year	1966	1991	1992	1993	1994	1995	1996	1997
Savannah sparrow			0.06	0.2	0.05		0.03	0.12
Clay-col. sparrow	0.72							
Raven	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Snipe	0.5				1	1	0.31	1.5
White-cr. sparrow	0.36	0.82	0.64	0.86	0.77	1.04	0.8	1.04
Br. head. cowbird						0.3	0.31	0.31
Robin						0.3		0.41
Red-sh. flicker						0.2		
Song sparrow	0.9	1.36	1.44	1.72	1.55	1.6	1.53	2.14
Willow flycatcher	0.36	0.5	0.37	0.41	0.49	0.58	0.61	0.77
Lincoln's sparrow	1.99	1.27	0.92	0.89	1.05	1.1	0.92	1
Yellowthroat	3.08	1.45	2.06	2.55	2.5	2.45	2.7	2.76
Yellow warbler	1.99	2	2.61	2.91	2.67	2.73	2.7	2.91
Fox sparrow	1	0.82	1.04	1.21	1.01	1.07	0.8	1
Magpie	0.5					0.2	0.15	0.5
Wilson's warbler	1.81	1.55	0.4	1.1	0.64	0.58	1.17	0.61
Warbling vireo							0.03	
Calliope humming	1.36		0.09	0.07	0.58	0.61	0.18	
Br. t. hummingbird							0.05	
Marsh wren			0.25		0.22	0.21	0.14	0.38
N. Waterthrush			0.18		0.15			0.09
MacGillivray's w.	0.09			0.26	0.08	0.12	0.11	0.15
Swainson's thrush	0.27		0.03					
Bl-headed grosbk						0.2		0.5
Gt. blue heron						0.01	0.01	0.05
Tree swallow						0.1	0.25	0.25
Bufflehead						0.3		
American coot						0.3		0.31
Bank swallow						0.15	0.25	
Barn swallow								0.25
Rough-w. swallow						0.15		0.125
Swainson's hawk						0.005		
Marsh hawk							0.05	
Cliff swallow						0.3	0.25	
Am. widgeon								
Mallard								0.15
Green-winged teal								0.15
Lesser scaup								0.15
Blue-winged teal								0.15
Gadwall							0.3	0.15
Bl. cap. chickadee							0.08	
Virginia rail				0.3	0.5			0.15

Site.10.Summary

TOT. SPP.:	15	9	14	13	16	26	25	29
PR/HA:	15.03	9.87	10.19	12.58	13.36	15.71	13.83	18.17

Site.10N.Summary

SITE 10N: COONSA CK WET WILLOWS		
Species/Year	1996	1997
Bufflehead		0.125
Northern pintail		0.125
Mallard		0.25
Raven	0.1	0.1
Am. crow	0.1	0.1
Sora	0.5	
Snipe	3.75	4
Red-sh.flicker	0.188	
Red.naped sapsucker		0.5
Downy woodpker	1.5	
Calliope humming		
Rufous humming	1	
Marsh wren		
Tree swallow	0.5	2
Rough-w. swallow	0.5	0.25
Violet-gr swallow	0.5	
Cliff swallow		
Barn swallow	0.25	
Bl.capped chickadee		1
Robin	1.5	0.75
Veery	2.25	2.5
Catbird	1.5	0.5
Cedar waxwing	0.25	1.5
Br.head.cowbird	2	2
Red-wing.blbird	3.5	3.5
Willow flycatcher	3.125	3.5
Warbling vireo	0.417	0.25
Yellowthroat	6	7.5
Yellow warbler	18	17.5
Wilson's warbler	0.5	
N. Waterthrush	5.5	6
MacGillivray's w.	1.5	2.25
Orange-cr.warbler	1.5	0.5
Am. redstart	1	
Bl.headed grosbeak		0.675
Savannah sparrow	0.75	0.93
White-cr.sparrow	0.875	1.75
Song sparrow	4.75	6
Lincoln's sparrow	2.5	0.865
Fox sparrow	2	3.5
Am. goldfinch	0.5	0.25
TOT. SPP.:	32	27
TOT.PR:	68.81	70.17
PR/HA:	6.88	7.02

Site.10S.Summary

SITE 10S: ONAHU CK WET WILLOWS			
Species/Year	1995	1996	1997
Savannah sparrow	0.5	0.3	1.875
Raven	0.1	0.1	0.1
American crow			0.1
Swainson's hawk			
Red-tailed hawk			0.05
Snipe	1.75	1	
White-cr.sparrow	1	1.9	1.375
Br.head.cowbird	1.25	1.5	0.25
Robin	0.75	1.5	1.125
Red-sh.flicker		0.75	0.375
Red-naped sapsucker			0.75
Song sparrow	1	0.5	0.75
Willow flycatcher	1.5	1.75	0.4
Dusky flycatcher	0.5	1.25	3.75
Lincoln's sparrow	6	12.2	17.5
Yellowthroat	1	0.3	1
Yellow warbler	0.75		
Fox sparrow	0.75	0.9	0.75
Magpie			
Wilson's warbler	4.75	11.2	11.5
Warbling vireo			
Calliope humming			
Br.t. hummingbird	1.25	1.5	3.5
Marsh wren	0.75		
N. Waterthrush			
MacGillivray's w.			
Swainson's thrush	0.25		
Bl-headed grosbk			
Cliff swallow	0.75		1.5
Violet-gr.swallow	0.75	1	0.75
Tree swallow	0.25		
Barn swallow	0.25		
Bl.capped chickadee	0.5		0.5
Mt. bluebird	0.25		0.25
Gt.bl.heron	0.05		0.05
Kingfisher	0.1	0.05	
Wh.br.nuthatch			0.375
Spotted sandpiper			0.05
Dark-eyed junco			0.5
Blue-w.teal		0.05	
TOT. SPP.:	25	18	25
TOT.DENS.:	26.75	37.75	49.13
PR/HA:	4.115	5.808	7.558

Site.11.Summary

SITE 11: OXBOW BEND WILLOW-ASPEN					
Species/Year	1993	1994	1995	1996	1977
Red-tailed hawk					
Roughed grouse					0.125
Raven	0.25	0.1	0.025	0.1	0.05
White-cr.sparrow	2	2	2	1	0.625
Br.head.cowbird	0.5	2	1.75	1.8	1
Robin	2	2.5	2.25	2.2	2.5
Northern flicker	1	1	1	0.85	0.75
Song sparrow	2	4	5.75	4.67	5
Amer.goldfinch				0.33	
Tree swallow	3	4	3	3.67	4.5
Br.tail.hummingb	1	0.5			0.5
Willow flycatcher	2	3	2.5	2	1
Lincoln's sparrow	1	2	2.5	2.5	2
Am. crow					
Yellow warbler	5	8	8.25	11.33	11.75
Fox sparrow	4	3.5	2.75	5	3
Magpie	1		1	0.5	0.25
Gray catbird		1	0.5		
Blk-c.chickadee		1.5	1	0.5	1.5
Wilson's warbler	2	1.5	1	0.25	0.5
Dusky flycatcher		0.5	1.5	3.5	2.25
Warbling vireo	1	1	2.5	3.67	2
Calliope humming		0.5	2	1.8	2
MacGillivray's w.	2	2	1.75	1.8	2
House wren	1	1	2.5	1.67	2
Downy woodpeckr	1	1	1	0.5	0.5
Swainson's thrush			0.5		
Bl-headed grosbk	1	1	0.5	1	1.5
Red-n.sapsucker		0.5	1	1	1.5
Pine siskin		0.5	1.5	0.85	
Cedar waxwing		1	2	0.67	2.5
Clark's nutcracker		0.25		0.05	0.25
Common yellowthroat			1.25	1.67	2
Euro.starling			0.375	0.33	1.625
Common snipe			1		0.5
Orange-cr. warbler			0.5		
Yell.headed blackbird					0.125
Brewer's blackbird			0.5	1.67	1.125
Cliff swallow					0.25
Barn swallow				0.08	0.5
Lazuli bunting					0.5
D.eyed junco				0.167	
Rufous hummer				0.33	1
TOT.SPP.:	19	26	31	32	34
TOT.DENS.:	32.75	45.85	55.65	57.46	59.05
PR/HA:	5.458	7.642	9.275	9.576	9.842

Site 12.Summary

SITE 12: ELK RANCH WEST LOW ASPEN							
Species/Year	1966	1992	1993	1994	1995	1996	1997
Raven	0.1	0	0.2	0.1	0.1	0.1	0.1
Br.h. cowbird				1	0.5	1	0.5
Green-t.towhee		0.5	0		1	1	0.5
White-cr.sparrow	4	6	4	4	4	2	4.5
Robin		2	1	3	2.5	3.5	1
Red-sh.flicker	1	1	2	2	1.75	1.5	1.75
Tree swallow	3	3	6	4	1.75	2	4.5
Br.tail.hummingb				0.5	0.5		
House finch		0	2	2			
Yellow warbler	3	0	2	1		1	0.5
Kestrel	0.1			0.1	0.05	0.5	0.1
Blk-c.chickadee	2			2	0.5	0.5	1
Warbling vireo	4	2	2	3.5	2.5	5	5
Calliope humming				0.5			
MacGillivray's w.	1				0.5		
Least flycatcher	3.7	0	1	1			
House wren	2	3	8	4.5	5.5	7	8.25
Downy woodpeckr	1	2	0	2	1.25	0.625	0.75
Dusky flycatcher	3.5	3	0	3	2.75	4	4.75
Red-n.sapsucker				2	1	1	1
Orang.-cr.warbler		0	3	1	1.5		0.375
W.wood pewee	4	3	3	2	1.75	2.5	1.25
Mt. bluebird	2	1	4	2	2.5	3	4
Yellow-r.warbler	2	2	0	1		1	
Dark-eyed junco	4	3	1	1	2.5	3	1.75
Swainson's hawk							0.05
Red-tailed hawk		0.1	0.1	0.1		0.1	0.05
Wh.br.nuthatch		0	1	1.5		0.5	1
Pine siskin		1	0	2	0.75	0.75	0.75
Ruffed grouse							
Clark nutcracker				0.5	0.75	0.375	0.875
Blue grouse					0.5		
Chipping sparrow					1.25		0.625
Bl.headed grosbeak					0.5		
Red crossbill					0.25	1	0.5
Cassin's finch						0.5	
Mt.chickadee						2	0.5
Hairy woodpecker						1	
Red-br.nuthatch						1	
W. tanager						0.5	
Violet-gr.swallow						1	
Lincoln's sparrow							0.75
Savannah sparrow							0.25
TOT.SPP.:	17	21	21	27	26	30	29
TOT.DENS.:	40.4	32.6	40.3	47.3	38.4	48.95	46.93
PR/HA:	6.22	5.015	6.2	7.277	5.908	7.531	7.219

Site.13.Summary

SITE 13: ELK RANCH EAST MID ASPENS							
SPECIES/Year	1966	1992	1993	1994	1995	1996	1997
Raven		0.2	0.2			0.1	0.05
Swainson's hawk			0.1				0.05
Br.h. cowbird	2	1.5					
Green-t.towhee		1					
White-cr.sparrow	4	3	3	4	1.5	3.5	2.75
Robin	2	1	2	2	1	3	2
Northern flicker	4	1	1	2	1.5	1.75	1
Tree swallow	10	3	3	2	0.5	1	2
Violet-green swallow					1		
Br.tail.hummingb		1					0.5
Rufous hummingbird					0.5		
Lazuli bunting				1			
House finch			1				
Yellow warbler	4	3	4	3	1.5	2.5	2
Kestrel			0.1	0.1		0.125	
Blk-c.chickadee	4	1	1	2	1.5	1	0.5
Mt. chickadee							1.5
Wilson's warbler				1			
Warbling vireo	12	2	3	3.5	2	4.25	4.25
Calliope humming				1			
MacGillivray's w.	2		1		0.5	1	0.5
Least flycatcher	6		4	1			
House wren	4	6	8	7.5	5	6	7.25
Downy woodpeckr		1	1	1	0.5	1	1
Dusky flycatcher	6	2		2	2	3.5	3.75
Red-n.sapsucker		1			0.5		1
Orang.-cr.warbler			1	1		1.75	0.25
W.wood pewee	8	2	2	4.5	1.5	2.5	3.25
Mt. bluebird	4	2	2	1.5	0.5	2.25	1.25
Yellow-r.warbler	2	1	1				0.5
Dark-eyed junco	6		1	2	0.5	2	2.5
Red-tailed hawk			0.05				0.05
Wh.br.nuthatch			1				
Pine siskin	1		1	1	0.75	2	0.5
Ruffed grouse			1				
Clark nutcracker		0.1		0.2	0.25	0.5	0.125
Hairy woodpecker						1	0.5
Gray jay						0.25	
Lincoln's sparrow							0.25
TOT.SPP.:	17	19	24	21	19	21	26
TOT.DENS.:	81	32.8	42.45	43.3	23	40.98	39.28
PR/HA:	16.2	6.56	8.49	8.66	4.6	8.195	7.855

SITE.14.Summary

SITE 14: COW LAKE TALL ASPEN							
SPECIES/Year	1966	62592	70193	1994	1995	1996	1997
Turkey vulture							0.01
Raven		0.1	0.1	0.1	0.1	0.1	0.05
Red-t. hawk				0.05		0.05	
Br.h. cowbird				1.5	0.5	1	1.5
Green-t.towhee			1	1.5		0.5	0.5
Robin	3	4	2	1.5	2.5	5.5	2.75
Northern flicker	2	1	2	1	2	1.25	1.5
Tree swallow	3	3	4	2	2	2	
Br.tail.hummingb		1					
House finch				0.5			
Yellow warbler			3			1	
Kestrel			0.1				
Blk-c.c.chickadee		3	1	2		1	0.5
Chipping sparrow	2	4	3	4	2	2.25	4.75
Wilson's warbler							
Warbling vireo	3	2.5	3	3	2	5.5	5.25
Calliope humming					0.5		
Least flycatcher	2	3		0.5			1
House wren	3	4	6	5	3.5	5.25	7.25
Downy woodpeckr		3	2	1		1	1
Dusky flycatcher	2	1	1	2	1.5	3.5	3
Williamson's spskr							0.5
Red-n.sapsucker		2		2	0.5	1	1.25
Orang.-cr.warbler							0.5
W.wood pewee	2	2.5	3	4	2.5	3.25	3.75
Mt. bluebird	2	1	3	1.5	2.5	2.5	3.5
Yellow-r.warbler	1	2	1	0.5	1	1	1.75
Dark-eyed junco	4	1	3	2.5	2.25	3.75	7
Wh.br.nuthatch				1	1		0.25
Pine siskin	6		1	1.5	1.75	3	2.5
Ruffed grouse	0.5						
Clark nutcracker				0.5	0.25	0.25	0.875
Red crossbill			1			0.25	0.25
Cedar waxwing				0.5			
Mt. chickadee				1	2		2.75
Gray jay				0.5		0.675	
W. tanager	1						
Cassin's finch	2				0.75	1	0.25
Hairy woodpecker	1				0.5	1	1
Red-breast.nuthatch					1	1	0.75
Great Gray owl					0.25		

SITE.14.Summary

Ruby-cr.kinglet						1	0.25
Williamson's sapsuck						0.5	
Violet-gr swallow						0.25	
Wh.cr.sparrow							0.75
TOT.SPP.:	17	17	19	26	23	29	29
TOT.DENS.:	39.5	38.1	40.2	41.15	32.85	50.33	56.93
PR/HA:	7.9	7.62	8.04	8.23	6.57	10.07	11.39

Site.15.Summary

SITE 15: SPREAD CREEK COTTONWOODS						
SPECIES/Year	1992	1993	1994	1995	1996	1997
Raven		0.2			0.05	0.05
Mourning dove			0.5			
Green-t. towhee	1		0.1			
White-cr.sparrow	2	2	2.5	4	1.25	3
Br.h. cowbird			0.25	1	0.5	0.5
Robin	3	4.5	3	4	7	5.25
Northern flicker	1.5	1	1	1	1.5	1.75
Song sparrow		0.5	0.5			
Amer.goldfinch		1	0.5	0.5		
Tree swallow	1	2				0.5
Br.tail.hummingb				0.5		1
Lincoln's sparrow	2	1	2	1	1.5	4
Yellow warbler	5	6	3.5	3.75	9.25	6.5
Fox sparrow	1.5	1	1	0.5	1.75	1
Blk-c.chickadee	2	2	2	1	2.25	2
Warbling vireo	2	4.5	4	3.5	6.5	3
Calliope humming	1		0.5	0.5	0.5	
Least flycatcher	3	3	2			
House wren	2	1	2	2	1.5	2
Downy woodpeckr	1	1		0.5	0.5	
Dusky flycatcher	2		3	4.5	4.5	5
Bl-headed grosbk				0.5		
Williamson's spskr						0.5
Red-n.sapsucker	1	1	1		1.25	0.5
W.wood pewee	3	2	4	3.5	4.5	3.75
Mt. bluebird		1			1.5	
Yellow-r.warbler	1	1	3	1.5	1.5	1
Dark-eyed junco	2	1.5	1	0.5	1	1.25
Red-tailed hawk	0.1	0.1	0.1		0.05	
Wh.br.nuthatch	1	1	1	1.5	0.5	
Mt. chickadee			0.5			0.5
Pine siskin		3	2	1.75	3	5.25
Ruby.cr.kinglet	2		1	1	1.5	2.5
Cassin's finch	1	2	3	1.5	2	1.5
C. nighthawk		1			0.5	
Pine grosbeak	1					0.25
Great gray owl				0.125		
Great horned owl						1
Chipping sparrow				0.5		
Clark's nutcracker				0.25	0.42	0.125
Hairy woodpecker						

Site.15.Summary

Rufous hummingbird					2	
Red-br.nuthatch					0.5	0.25
MacGillivray's w.					0.5	
Common snipe						1.25
TOT.SPP.:	24	25	27	26	29	28
TOT.DENS.:	42.1	44.3	44.95	40.88	59.27	55.18
PR/HA:	7.017	7.383	7.492	6.813	9.878	9.196

Site.16.Summary

SITE 16: SCHWABACHER COTTONWOODS						
SPECIES/Year	1992	1993	1994	1995	1996	1997
Raven	0.1	0.1	0.1	0.1	0.1	0.05
Am. crow					0.33	
Mourning dove			1.5			
White-cr.sparrow	2	0	2	1.5	2.33	1.75
Br.head.cowbird	0	0.5	1	0.75	2.2	2.5
Robin	5	3	3	5.5	7.33	7
Red-sh.flicker	1	1.5	1.5	1.5	1.25	1
Song sparrow	0	0.5		1.75	3.42	3.375
Lincoln's sparrow					1.5	1
Tree swallow	1	2	1		0.5	0.75
Cliff swallow					0.25	0.5
Bank swallow					0.5	2.5
Rough-w. swallow					1	
Gt. gray owl			0.1			
Gt.horned owl					0.5	
House finch	0	1				
Yellow warbler	6	10	8	12	12.33	16.75
Blk-c.chickadee	2	1	2	1	3	3
Warbling vireo	3	3	1	2	4.17	4
Least flycatcher	2	2	1		1	
House wren	2	4	3	2.75	3.67	2.5
Downy woodpeckr	2	1		0.5		1
Swainson's thrush			1			
Dusky flycatcher	1	3	2	3.5	7.67	6
Wh.br.nuthatch			1	1	0.75	1
Bl-headed grosbk	0	1	1	0.5	0.5	
Rufous hummer			1		1.67	
Red-n.sapsucker	1	0		0.5	1	1
W.wood pewee	1	1	1		0.5	
Mt. bluebird	0	1			0.5	0.5
Yellow-r.warbler	1	2	4	1.75	3.67	4
Dark-eyed junco	0	1	1	3	4.67	5
Red-tailed hawk	0	0.1	0.1			
Cassin's finch			2	1	1	0.5
Pine siskin	0	2	2.5	2.5	5.17	3.75
Ruffed grouse	0	1			1.25	
Chipping sparrow	2	2	1	1	2	4.25
Ruby-cr.kinglet	1	5	1	1.75	4.33	3
Cedar waxwing	1	0	1.5	1.5	0.83	0.5
Mt. chickadee	0	1	1	1	0.5	1
Red-br. nuthatch	0	1			1.5	

Site.16.Summary

MacGillivray's warbler				1		
Broad-t.hummer				1		1.5
Cooper's hawk				0.05		
Hairy woodpecker				0.5	0.5	
Rough-w.swallow				0.25		
Fox sparrow				0.5		
Am goldfinch					0.5	
Common snipe					0.5	
Spotted sandpiper					0.125	
Sandhill crane					0.05	
Red Xbill				0.25		
Brewer's blackbird						1.25
TOT.SPP.:	29	29	28	30	40	28
TOT.DENS.:	34.1	50.7	46.3	51.9	84.57	79.68
PR/HA:	4.547	6.76	6.173	6.92	11.28	10.62

SITE.17.Summary

SITE 17: LOWER GRANITE CY LODGEPOLE-ASPEN				
SPECIES/Year	1995	1996	1997	
Raven	0.05	0.05	0.05	
Gray jay		1		
White-cr.sparrow	0.25			
Robin	1.75	4.25	2.75	
Red-sh.flicker	1.5	0.825	0.5	
Tree swallow	1		0.5	
Cliff swallow	0.5		0.25	
Warbling vireo	1	4	4.5	
House wren	1	0.5	1	
Dusky flycatcher	1.5	4.25	3	
W.wood pewee	0.5		1.5	
Mt. bluebird	0.75	0.063		
Yellow-r.warbler	1.75	6.5	4	
Dark-eyed junco	5.75	9.5	9.75	
Red-tailed hawk	0.025			
N. goshawk		0.125		
Cassin's finch	1	1		
Pine siskin	2.25	4.25	4.5	
Chipping sparrow	5.75	5	6.75	
Ruby-cr.kinglet	1.625	4	3.75	
Mt. chickadee	3	3	5.25	
Bl.c.chickadee		0.5	0.25	
Red-br. nuthatch	2.25	2.5	2.5	
Downy woodpecker			1.5	
Hairy woodpecker	1.5	0.25	1	
Red Xbill	1.5	1.5	0.75	
Western tanager	2.75	4.75	3	
Golden-cr. kinglet	0.5			
Green-t. towhee	1.25	0.125	1.25	
Clark's nutcracker	0.5	0.25	0.5	
Ol.sided flycatcher		0.5		
Br.headed cowbird		0.5		
Black-h. grosbeak			0.5	
Pine grosbeak		1	0.25	
Broad-t. hummer			0.5	
Rufous hummer			1.5	
Williamson's spskr			0.5	
Red-naped sapsucker			0.5	
American kestrel			0.05	
TOT.SPP.:	26	26	30	
TOT.DENS.:	41.2	60.19	62.6	
PR/HA:	7.848	11.46	11.92	

Site.18.Summary

SITE 18: TIMBERED ISLAND LODGEPOLE-SPRUCE					
SPECIES/Year	1994	1995	1996	1997	
Raven			0.05	0.1	
Chipping sparrow	2	2.75	3	5.5	
Am. robin	1	1	2.5	1.5	
Dark-e. junco	4	2	9.5	6	
Hairy woodpecker	0.5			0.5	
Pine siskin	0.5	2	3.5	3.25	
Mt. chickadee	2	2.75	3.5	3.5	
Red-br. nuthatch	1	0.5	1.5	1.5	
Gray jay	1		0.5	0.25	
Ruby-cr. kinglet	1.5	0.25	5	1.5	
W. tanager	1.5	2	3	2.5	
Red-sh. flicker	0.5	0.75	0.25	0.25	
Warbling vireo	0.5				
Yellow-r. warbler	0.5	1	4	2.75	
Clark's nutcracker	0.5	0.25	0.25	1	
Hermit thrush		0.5			
Cassin's finch		0.25	0.5		
Red crossbill		1	0.825	0.5	
Fox sparrow		0.25			
Pine grosbeak			0.5	0.25	
Three-toed wdpker			0.5		
Br.t.hummer			0.5		
Sh.shinned hawk			0.125		
Three-toed woodpecker				0.25	
TOT. SPP.:	14	15	18	16	
TOT. DENS.:	17	17.25	39.45	31	
PR/HA:	3.4	3.45	7.89	6.2	

SITE.19.Summary

SITE 19: AMK LODGEPOLE						
SPECIES/Year	1992	1993	1994	1995	1996	1997
Br.head.cowbird	2	1.5	1	2	1	1.25
Raven	0.5	0.5	0.5	0.1	0.1	0.05
Wh.cr.sparrow	1	1	0.5	0.75		0.75
Robin	3	3	2.5	3.25	3.25	1.75
Red-sh.flicker	1	1.5	1	1.25	0.5	0.5
Red-tailed hawk			0.1	0.05		
Br.tail.hummingb			0.5			
Violet-gr.swallow	0.5		1	1	0.5	0.5
Tree swallow					0.25	
Cliff swallow				1		0.675
Warbling vireo	2	2	2.5	3	2.25	1.75
Swainson's thrush	1	1	1	1.75		1.5
Dusky flycatcher			1	0.5	0.5	0.5
Red-n.sapsucker	0.5					0.25
W.wood pewee	4	2	2	2.5	2.75	1.5
Yellow-r.warbler	4	3.5	6	6.5	6.25	7.5
Dark-eyed junco	8	5	5	5.25	5.5	3.375
Pine siskin	2	1	4	4	4	2.75
Chipping sparrow	4	3	4	2.75	4	3.5
Red crossbill	1		1.5	2	3	1.75
Ruby-cr.kinglet	5	3.5	2	4.25	3.5	2.25
Cassin's finch	2	1	2	2	1.5	2
Pine grosbeak		0.5	0.5		0.5	
Red-br.nuthatch	3	2	3	3	1.5	1.25
Mt. chickadee	3	1	2	3	2.5	2.5
Gray jay	0.5	0.5	0.5	1	0.25	0.5
Clark's nutcracker	0.75		0.5			
Western tanager	2.5	2	2	2.25	3.5	1.75
Ol.sided flycatcher	1				0.25	
Hairy woodpecker	1	1	1	1.25	1.25	0.875
Blue grouse	0.5		0.5			
Ruffed grouse					0.25	
Brown creeper	0.5				1	
Hermit thrush		0.5			0.75	0.625
W. flycatcher					0.5	
Williamson's spskr					0.25	
Townend's warbler						0.5
MacGillivray's warbler						0.5
TOT.SPP.:	26	21	27	24	28	27
TOT.DENS.:	54.25	37	48.1	54.4	51.35	42.6
PR/HA:	9.042	6.167	8.017	9.067	8.558	7.1

Site 20.Summary

SITE 20: TAGGART LAKE LODGEPOLE BURN					
SPECIES/Year	1994	1995	1996	1997	
Br.head.cowbird		1	0.5	2	
Raven		0.1	0.05	0.05	
Wh.cr.sparrow		1.5	4.25	5.625	
Robin	1	2.25	2.75	2.25	
Red-sh.flicker		0.75	0.75	1.25	
Rufous hummingbird		1		0.5	
Violet-gr.swallow	1	0.5		0.5	
Cliff swallow	1				
Tree swallow		1	0.5	1.25	
Dusky flycatcher		2	1.5	2.25	
Hammond's flycatcher		0.5			
W.wood pewee		1.5	2.25	3.25	
Yellow warbler	1	1.75	4	3.25	
Dark-eyed junco	2	1	3.5	2.25	
Pine siskin		1.75	3.25	3	
Chipping sparrow	5	2.25	2	3.25	
Red crossbill		1	0.25		
Cassin's finch		1.25	1.5	2.5	
Hairy woodpecker		1	1	1.5	
Lincoln's sparrow		0.5	0.5		
Green-t. towhee		1	1.5	2.25	
House wren	2	2	1.75	2	
Mountain bluebird	2	1.5	1.5	1.75	
Cedar waxwing		0.5		0.5	
Gray jay		0.25			
Cooper's hawk		0.1			
Vesper sparrow	1				
Townsend's solitaire	1				
Olive-sdd.flycatcher	1			0.5	
Swainson's thrush			2	1.75	
MacGillivray's w.			0.5		
Clark's nutcrker			0.25	0.25	
Yellow-r. warbler				1	
Western tanager				0.5	
Warbling vireo				0.5	
TOT.SPP.:	11	25	22	26	
TOT.DENS.:	18	27.95	36.05	45.68	
PR/HA:	3.214	4.991	6.438	8.156	

SITE.21.Summary

SITE 21: SIGNAL MOUNTAIN LODGEPOLE-SPRUCE						
SPECIES/Year	1992	1993	1994	1995	1996	1977
Raven		0.1	0.1	0.1	0.067	0.1
Robin	2	2	1.5	1.75	0.25	0.75
Red-sh.flicker	1		1	1	0.25	0.25
Gr.t.towhee		1	0.25	0.25		
Br.tail.hummingb			0.5			
Violet-gr.swallow			0.5			
Warbling vireo	1	0.5		0.25	0.333	0.25
Dusky flycatcher						
Swainson's thrush	1	1.5		0.5		0.5
W.wood pewee						
Yellow-r.warbler	4	5	5	4	6.67	4.75
Dark-eyed junco	3	4	5	5.25	4.33	3.25
Red-tailed hawk						
Rufous hummer			0.5			
Pine siskin	2	3	2	1.75	3	2.25
Chipping sparrow	2	2	3	2	1.67	2
Red crossbill	1		1	1.5	1.67	0.75
Ruby-cr.kinglet	2	2	1	2	1.33	1.5
Cassin's finch		1	1	0.5	0.333	0.5
Pine grosbeak			1	1.25	0.667	
Red-br.nuthatch	3	2	3	1.5	1.67	1.5
Wh.br.nuthatch					0.333	
Cedar waxwing						
Mt. chickadee	2	1	2	2.5	2.67	2.25
Gray jay	1	1	1	1	0.444	1
Clark's nutcracker			0.5	1	0.25	0.125
Western tanager	3	1	2	2	3.167	4
Townsend solitaire		1			0.333	0.25
Ol.sided flycatcher	1					
Hairy woodpecker	1		1	1.5	0.5	1
Evening grosbeak			0.5		1	
Blue grouse			1			
Brown creeper				0.5		
Hermit thrush	3	2	2.5	1.75	1.333	1.5
N.3-td.woodpkr						
Cliff swallow				0.5	0.667	
TOT.SPP.:	17	17	24	23	23	20
TOT.DENS.:	33	30.1	36.85	34.4	32.94	28.48
PR/HA:	4.714	4.3	5.26	4.91	4.705	4.068

Site.22.Summary

SITE 22: SPAULDING BAY DOUGLAS FIR				
SPECIES/Year	1995	1996	1977	
Raven		0.1	0.05	
Robin	1.75	1.75	1.5	
Red-sh.flicker	0.5	0.25	1	
Gr.t.towhee	1	1.25	2	
Warbling vireo	2.5	5.875	4.75	
W.wood pewee	0.5	1		
Yellow-r.warbler	5	4.25	5.75	
Dark-eyed junco	1.375	6.125	4.75	
Pine siskin	3	5.25	4.25	
Chipping sparrow	3.5	3.25	5.5	
Red crossbill	0.5	1.875		
Ruby-cr.kinglet	2.5	5.625	3.25	
Cassin's finch	1.75	0.5	0.5	
Pine grosbeak	0.75	0.5		
Red-br.nuthatch	2	1.5	2	
Wh.br.nuthatch	0.5			
Mt. chickadee	2	2.25	2.25	
Clark's nutcracker	0.25	0.5	0.125	
Western tanager	2	3.75	2	
Ol.sided flycatcher	1			
Hairy woodpecker	0.5	0.5	0.25	
Ruffed grouse	1			
Lincoln's sparrow	0.5		0.5	
Mt bluebird	0.5	0.5		
Br.h. cowbird	0.5	0.25	1	
Williamson's sapsucker	0.5	0.375		
Fox sparrow	0.5			
Gray jay		0.75		
Red-t. hawk		0.05	0.05	
Dusky flycatcher		0.5	0.5	
Brown creeper		0.5		
Br.t.hummingbird		0.5	1.5	
Hermit thrush			0.375	
Sharp-sh.hawk			0.1	
TOT.SPP.:	26	27	23	
TOT.DENS.:	36.38	49.53	43.95	
PR/HA:	6.272	8.539	7.578	

Site.23.Summary

SITE 23: LIZARD CREEK SPRUCE-LODGEPOLE						
SPECIES/Year	1992	1993	1994	1995	1996	1997
Red-tailed hawk						0.05
Raven			0.1	0.1	0.05	0.1
Robin		2	1	2	2	2.5
Red-sh.flicker			2	0.875	0.5	
Br.h. cowbird			0.5			
Lincoln's sparrow			4	2	1.5	3.25
Mc Gillivray's warb			1	2	1.25	1.5
Warbling vireo			1	1.25	1.25	2
W.? flycatcher			1	0.5		
Rufous hummer			1			
Calliope hummingbird				0.5		
Swainson's thrush		3	4	2.25	2.625	2.5
Yellow-r.warbler		3	6	2.75	5.25	5.5
Dark-eyed junco		2	7	2.875	5.25	3.75
Pine siskin		2	3	2.75	4	3
Ruffed grouse	yes					0.5
Chipping sparrow			1	1.75	0.25	2.5
Red crossbill			1	2	2	1.25
Ruby-cr.kinglet		4	4	1.5	3	2.75
Cassin's finch			2		1	1
Pine grosbeak				1	0.5	0.25
Red-br.nuthatch			4	1.75	2	1.5
Williamson's sapsuck			1			0.5
Red-naped sapsuck			1	0.5		
Mt. chickadee		2	4	1.5	2.5	2.5
Gray jay			1	1	1	0.75
Clark's nutcracker			1	0.25	0.75	0.5
Western tanager			1	0.5	1.5	1
Hairy woodpecker		1	1	0.5	1	0.5
Brown creeper			1	1	0.5	
Hermit thrush		1		0.25		1
N.3-td.woodpkr			1	0.5		
Golden-cr. kinglet				0.5	0.5	
TOT.SPP.:		9	27	27	23	23
TOT.DENS.:		20	55.6	34.35	40.18	40.6
PR/HA:		4.167	11.58	7.156	8.37	8.458

Site.24.Summary

SITE 24: BRADLEY LAKE SPRUCE-PINE				
SPECIES/Year	72294	1995	1996	1997
Raven		0.1	0.1	0.1
Robin	1	0.5	2.25	2
Red-sh.flicker	1	1	0.5	1.25
Br.tail.hummingb		0.5	1	
Rufous hummingbird		0.5		0.25
Warbling vireo	2	1	1.25	1
MacGillivray's w.	1	1	1	0.75
Hammond's flycatcher	1	1	1	1
Dusky flycatcher				0.5
Lincoln's sparrow				0.5
Swainson's thrush	2	1.25	0.75	1
Bl-headed grosbk		0.5		
Yellow-r.warbler	3	1.5	4.5	2.5
Dark-eyed junco	2	2	4.5	4.5
Red-tailed hawk				
Am. kestrel			0.125	
Cooper's hawk			0.125	
Pine siskin	2	2	2.5	3.25
Chipping sparrow	2	1	2	1.5
Red crossbill	2	1.25	1.5	0.5
Ruby-cr.kinglet	1		2.5	1
Golden-cr. kinglet	1	0.5	1	
Cassin's finch	2	0.5	2	2.125
Pine grosbeak			0.5	0.5
Red-br.nuthatch	2	1.5	2.5	2.25
Wh.br. nuthatch	1			
Mt. chickadee	2	1	3.5	2.25
Gray jay				0.5
Steller's jay	1	0.5	0.5	0.25
Clark's nutcracker		0.5	1	0.375
Western tanager	2	2.375	3.25	3
Ol.sided flycatcher	1	0.5	1.5	1.5
W.wood pewee			0.75	1.75
Hairy woodpecker	1	1	1	
Brown creeper			0.5	0.625
Hermit thrush		1	0.5	0.5
Wh.cr. sparrow		1.25		2
N.3-td.woodpkr		0.5		
House wren		0.5		
Green-t. towhee		0.5	0.25	1
Williamson's spsckr			0.25	0.75
Wilson's warbler				0.5
TOT.SPP.:	21	29	31	32
TOT.DENS.:	29	19.6	44.6	41.48
PR/HA:	4.833	3.267	7.433	6.913

Site.25.Summary

SITE 25: JENNY LAKE SPRUCE-FIR					
SPECIES/Year	1993	1994	1995	1996	1997
Raven	0.2	0.1	0.1	0.1	0.1
Robin	2	2	1.5	1.25	3
Red-sh.flicker	1	0.5	0.5	0.5	
Br.tail.hummingb		0.5			
Rufous hummingbird			0.5	0.5	3
Lincoln's sparrow					
Violet-gr.swallow					
Calliope humming		1			
Warbling vireo	1	1	0.5	1.25	
MacGillivray's w.	2	4	2	4.25	5
Wilson's warbler					0.5
Dusky flycatcher				0.5	0.5
Hammond's flycatcher		1	1		
Swainson's thrush	2	3.5	2.25	1.5	3.25
Bl-headed grosbk	1				0.5
Red-n.sapsucker					
W.wood pewee	1	1			
Yellow-r.warbler	5	7	4	6.5	4.75
Dark-eyed junco	4	4.5	1.5	4	5
Red-tailed hawk				0.1	0.05
Pine siskin	1	2	1.5	3.5	4
Blue grouse			0.5		
Chipping sparrow	1	3	1.25	1.5	2.75
Red crossbill			2	1	1.25
Ruby-cr.kinglet	2	2	1	2.5	1.75
Golden-cr. kinglet			1.5	1.5	3
Cassin's finch				1	
Pine grosbeak					
Red-br.nuthatch	1	3.5	1.75	2.5	1.75
Cedar waxwing					
Mt. chickadee	1	4	1.25	3.5	2.25
Gray jay				0.125	1
Steller's jay		1			1.25
Clark's nutcracker			0.25	0.25	
Western tanager	1	3.5	1.75	4.25	3.25
Ol.sided flycatcher			0.5	0.5	
Hairy woodpecker				0.5	1.5
Brown creeper		1	0.5	0.5	1.5
Hermit thrush	0.5			1	
Spotted sandpiper					0.05
Bald eagle					0.01

Site.25.Summary

Townsend's solitaire					0.5
Williamon's spskr					
N.3-td.woodpkr		1			
TOT.SPP.:	17	21	22	26	26
TOT.DENS.:	26.7	47.1	27.6	44.58	51.46
PR/HA:	4.855	8.564	5.02	8.105	9.356

Site 26.Summary

SITE 26: UPPER GRANITE CANYON SPRUCE					
Species/Year	1994	1995	1996	1997	
Raven				0.1	
Steller's jay			0.5		
Robin		0.5	1	1	
Red-sh.flicker				0.5	
Br.tail.hummingb		0.5			
Rufous hummer			0.5		
Swainson's thrush		0.5		0.5	
Yellow-r.warbler	2	2	0.5		
Dark-eyed junco	4	1.5	3.75	3.5	
Pine siskin	2	3.5	4.75	1.75	
Chipping sparrow	2		0.5	0.5	
Red crossbill		1.75	3.75	1	
Ruby-cr.kinglet	1			1	
Rufous-s. towhee				0.5	
Cassin's finch	1				
Pine grosbeak		0.5			
Red-br.nuthatch	2	2	1.75	2.5	
Mt. chickadee	4	1.25	2.5	5	
Clark's nutcracker		0.25	0.75	1	
Western tanager	2	1.5	1.75	3.5	
G.cr. kinglet	3	1.5	2	1	
Olive-s. flycatcher				0.5	
Hammond's flyctch	1				
Brown creeper	1	1.5	1	1	
Hermit thrush	1	1		2.5	
Williamson's sapsckr		0.5			
American dipper		0.25	0.25		
W.wood pewee			0.5		
Goshawk				0.05	
TOT. SPP.:	13	17	16	19	
TOT. DENS.:	26	20.5	25.75	27.4	
PR/HA:	6.5	5.125	6.438	6.85	

Site 27.Summary

SITE 27: RENDEZVOUS MOUNTAIN SPRUCE-PINE-FIR					
SPECIES/Year	1994	1995	1996	1977	
Raven	0.1	0.1	0.05	0.1	
Robin	0.5				
Mt. bluebird	1	0.5			
Red-sh.flicker	0.25	0.1		1	
Cliff swallow	0.5				
Yellow-r.warbler		1			
Western tanager		0.5			
Dark-eyed junco	2.5	2.5	2.5	2.5	
Red-tailed hawk					
Pine siskin	1	3.5	9.75	2.5	
Blue grouse		0.5		0.25	
Chipping sparrow	0.5		0.5		
Red crossbill		1.25	4	1	
Ruby-cr.kinglet		0.5	0.5	0.5	
Cassin's finch	1		1.5		
Pine grosbeak	0.5		1.5		
Red-br.nuthatch			1	2.5	
Cedar waxwing					
Mt. chickadee	1.5	0.5	2	1.5	
Clark's nutcracker	1	2	0.75	1.75	
Ol.sided flycatcher					
Hammond's flytch					
Hermit thrush	1.5			0.5	
N.3-td.woodpkr					
Pygmy owl		0.125			
Townsend's solitaire		0.5		0.5	
Wh.cr.sparrow			1	2	
Evening grosbeak			0.75		
Gray jay			0.5		
Wh.winged crossbill			0.75		
N. flicker			0.5		
Rufous hummingbird				0.5	
TOT. SPP.:	13	14	16	14	
TOT. DENS.:	11.85	13.58	27.55	17.1	
PR/HA:	2.37	2.715	5.51	3.42	

Site.28.Summary

SITE 28: CODY BOWL TUNDRA				
SPECIES/Year	1994	1995	1996	1977
Raven	0.1	0.1	0.05	0.1
Am. pipit	1	1	1.5	1
Bl.rosy finch	2	1.5	3.5	1.5
Rock wren	2			1
Wh.crsparrow		0.5	1.5	0.5
Rufous hummingbird		1	0.5	
Br.t.hummingbird			0.75	
Cliff swallow		2		1
Mt bluebird			0.375	0.5
Cassin's finch			0.25	
Prairie falcon			0.05	
Golden eagle			0.01	
Clark's nutcracker			0.5	1.5
N. flicker			0.25	
D.e. junco			0.25	3
Pine siskin				0.5
TOT. SPP.:	4	6	13	10
TOT. DENS.:	5.1	6.1	9.485	10.6
PR/HA:	0.255	0.305	0.474	0.53

SITE.29.SUMMARY

SITE 29: HERON POND/SWAN LAKE WATERFOWL SURVEY						
SPECIES/Year	1995	1995	1996	1996	1977	1977
Site:	HP	SL	HP	SL	HP	SL
White pelican	4		1.25	1	2	
Gt.blue heron			1	1	2	1
Sandhill crane	1	1pr		3pr+1j		
Trumpeter swan		1pr		1pr		1pr
Canada Goose	11+13ch		24A+2j	4A+5j	24A+6j	
Common merganser	4					
American widgeon		2pr+2f	1f+3j	1f	2m,1f+6j	1f+4j
Gadwall	2f+13ch	3f+13ch	2F+5j	1F+5j		1m,2f
Wood duck		1				1m
Ring-necked duck		3pr+12	1f+6j	14A	1f+6j	7m,2f
Lesser scaup		2pr+4			1f	5
Mallard		2	1m,5f	3A+2j	1m,2f+1	2f+3j
Cinnamon teal				1m		
Redhead				1f+7j		
C. goldeneye						1f
Bufflehead						
Bald eagle						1
Osprey	1pr		1	1	1	1Pr
Coot		1pr		1pr		
Spotted sandpiper	1		3		3	
Ring-billed gull						
California gull	1	1	1		1	1
Ringed kingfisher	1			1	1	1
Red-w. blackbird		1				
Common snipe						
TOT. SPP.:	9	11				
TOT. DENS.:						
PR/HA:						

Site.30.Summary

SITE 30: BLACKTAIL PONDS AERIAL FORAGERS COUNT					
SPECIES/Year	1996		1997		
Total # Indivs	Total	Mean	Total	Mean	
Violet-green swallow	9	2.25	7	1.17	
Tree swallow	22	5.5	5	0.83	
Cliff swallow	17	4.25	18	3	
Barn swallow	1	0.25	1	0.17	
N.rough-winged swallow	7	1.75	0	0	
Bank swallow	4	1	1	0.17	
	n=4		n=6		